

—THE—
**HOME KNOWLEDGE
ATLAS.**

GEOGRAPHICAL,
ASTRONOMICAL,
HISTORICAL.

Showing the greatest number of Maps of any Atlas published in the world.

Containing a complete Gazetteer showing all the Cities, Towns, Villages and Post Offices
in the Dominion of Canada and the United States. Fully Indexed.

COMPILED FROM THE LATEST AND MOST AUTHENTIC SOURCES.

TORONTO:
HOME KNOWLEDGE ASSOCIATION.
1889.

Copyrighted 1887.

AFGHAN
AFRICA
ALASKA
ALABAMA
ALGERIA
ARIZONA
ARKANSAS
ASIA...
AUSTRIA
AUSTRIA
BELGIUM
BRITISH
BRITISH
CALIFORNIA
CENTRAL
CENTRAL
CEYLON
CHINA...
CITIES—
COLORADO
CONNECTICUT
CORSIKA
CUBA...
CYPRUS
DAKOTA
DELAWARE
DENMARK
EAST INDIA
EGYPT...
ENGLAND
EUROPE
FLORIDA
FRANCE
GERMANY
GEORGIA
GREECE
HEMISPHERE
HEMISPHERE
HOLLAND
IDAHO...
ILLINOIS
INDIA...
INDIANA
INDIAN

ALEXANDRIA
ATHENS
ATLANTA
BALTIMORE
BOSTON...
BROOKLYN
BERLIN, C
BRUSSELS
BELFAST
CALCUTTA
CONSTANTINOPLE
CHICAGO
CINCINNATI
COPENHAGEN

TABLE OF CONTENTS.

MAPS OF MODERN GEOGRAPHY.

	MAPS.	INDEX.		MAPS.	INDEX.		MAPS.	INDEX.
AFGHANISTAN.....	214		IOWA.....	115	361	ONTARIO, EASTERN PART OF.....	20-21	341-344
AFRICA.....	224-225		ISLANDS IN ATLANTIC OCEAN.....	225		“ N. W. PART OF.....	24-25	341-344
ALASKA.....	6	347	“ “ PACIFIC “ “.....	226		OREGON.....	143	395
ALABAMA.....	126	345	IRELAND.....	197		OCEANICA.....	223	
ALGERIA.....	224		ITALY.....	205		PALESTINE.....	212-213	
ARIZONA.....	135	347	JAPAN.....	221		PENNSYLVANIA.....	106-107	396
ARKANSAS.....	129	347	KANSAS.....	117	364	PERSIA.....	211	
ASIA.....	208-209		KENTUCKY.....	109	366	POLAR WORLD.....	7	
AUSTRIA.....	204		LOUISIANA.....	128	368	PORTUGAL.....	200	
AUSTRALIA.....	222		MALTA, ISLAND OF.....	186		QUEBEC, WESTERN PART OF.....	28-29	341-344
BELGIUM.....	199		MAINE.....	98	369	“ WEST CENTRAL PART OF.....	32-33	341-344
BRITISH AMERICA.....	10		MANITOBA.....	72-73	341-344	“ EAST “ “.....	36-37	341-344
BRITISH COLUMBIA.....	80-81	341-344	MARYLAND.....	105	370	“ EASTERN “ “.....	40-41	341-344
CALIFORNIA.....	144-145	349	MASSACHUSETTS.....	100	372	RHODE ISLAND.....	100	401
CENTRAL AMERICA.....	190		MEXICO.....	189		RUSSIA.....	207	
CENTRAL ASIA.....	214		MICHIGAN.....	113	373	SCOTLAND.....	196	
CEYLON.....	215		MISSISSIPPI.....	127	376	SICILY.....	205	
CHINA.....	220-221		MISSOURI.....	116	378	SOUTHERN AFRICA.....	218	
CITIES—PLANS OF FOREIGN.....	187-188		MINNESOTA.....	119	375	SOUTH AMERICA.....	192-193	
COLORADO.....	133	350	MONTANA.....	138-139	380	SOUTH CAROLINA.....	123	401
CONNECTICUT.....	101	351	MOROCCO.....	224		SPAIN.....	200	
CORSICA, ISLAND OF.....	183		NEW HAMPSHIRE.....	99	382	SWEDEN.....	198	
CUBA.....	191		NEW YORK.....	102-103	384	SWITZERLAND.....	202	
CYPRUS, ISLAND OF.....	184		NEW MEXICO.....	134	384	TASMANIA.....	222	
DAKOTA.....	120-121	351	NEW JERSEY.....	104	383	TENNESSEE.....	109	402
DELAWARE.....	105	353	NEW BRUNSWICK.....	60-61		TEXAS.....	130-131	405
DENMARK.....	199		“ “ NOR. PART OF.....	64-65		TUNIS.....	204	
EAST INDIES.....	228		“ “ SO. PART OF.....	68-69		TURKEY.....	206	
EGYPT.....	219		NEBRASKA.....	118	381	TURKISH EMPIRE IN EUROPE AND ASIA.....	210	
ENGLAND.....	195		NEVADA.....	146	382	UNITED STATES.....	96-97	
EUROPE.....	194		NEW TIME STANDARD.....	95		UTAH.....	136	407
FLORIDA.....	125	353	NORTH CAROLINA.....	122	389	VERMONT.....	99	408
FRANCE.....	201		NORTH AMERICA.....	8-9		VIRGINIA.....	108	408
GERMANY.....	203		NORTHWEST TER., CENTRAL.....	70-71	341-344	WALES.....	195	
GEORGIA.....	124	354	“ “ NORTHWEST.....	84-85		WASHINGTON TERRITORY.....	142	411
GREECE.....	206		“ “ NORTHERN.....	88-89		WEST INDIES.....	190	
HEMISPHERE—EASTERN.....	233		NOVA SCOTIA.....	44-45		WEST VIRGINIA.....	108	412
HEMISPHERE—WESTERN.....	232		“ “ SO. PART OF.....	48-49		WISCONSIN.....	112	413
HOLLAND.....	199		“ “ NOR. PART OF.....	52-53		WORLD—GLOBULAR.....	229	
IDAHO.....	141	356	NORWAY.....	198		“ —MERCATOR.....	232-233	
ILLINOIS.....	114	356	NUBIA.....	219		“ —IN HEMISPHERES.....	230-231	
INDIA.....	216-217		OHIO.....	110	391	WYOMING.....	137	415
INDIANA.....	111	359	ONTARIO, S. W. PART OF.....	12-13	341-344	YELLOWSTONE NATIONAL PARK.....	140	
INDIAN TERRITORY.....	132	361	“ CENTRAL PART OF.....	16-17	341-344			

MAPS AND PLANS OF CITIES.

	PAGE.		PAGE.		PAGE.
ALEXANDRIA, Egypt.....	184	ETROIT.....	169	NEW YORK.....	148-149
ATHENS, Greece.....	181	DUNDEE, Scotland.....	179	NICE, France.....	183
ATLANTA.....	164	GENOA, Italy.....	181	PARIS, “.....	172-173
BALTIMORE.....	153	GLASGOW, Scotland.....	179	PHILADELPHIA.....	154-155
BOSTON.....	150	JERUSALEM.....	185	PORTLAND.....	165
BROOKLYN.....	147	KANSAS CITY.....	161	ST. LOUIS.....	158
BERLIN, Germany.....	171	KILLARNEY, Ireland.....	180	ST. PETERSBURG, Russia.....	178
BRUSSELS, Belgium.....	170	LIVERPOOL, England.....	167	SAN FRANCISCO.....	166
BELFAST, Ireland.....	180	LONDON, “.....	168-169	SYMRNA.....	186
CALCUTTA, India.....	174	MARSEILLES, France.....	183	STOCKHOLM, Sweden.....	177
CONSTANTINOPLE, Turkey.....	176	MILWAUKEE.....	163	TORONTO.....	152
CHICAGO.....	157	MONTREAL.....	151	VALENCIA, Spain.....	182
CINCINNATI.....	159	NAPLES, Italy.....	176	VALETTA, Malta.....	182
COPENHAGEN, Denmark.....	183	NEW ORLEANS.....	160	WASHINGTON.....	150

HISTORICAL AND CLASSICAL MAPS.

	PAGE.		PAGE.
ANCIENT ASIA MINOR—B. C. 650-325	298	GREECE—B. C. 1200-146	294
ANCIENT CITY OF ROME	322	GREECE—Homerics	290
ANCIENT ATHENS	300	INDIA—In 1751	320
ANGLO SAXON KINGDOM—457-1066	312	ITALY—In the 17th Century	319
BIRTHPLACE OF CIVILIZATION	299	—B. C. 800-322	292
BRITISH ISLES—A. D. 1066	313	PROPER—Ancient	296
CANAAN AND ROUTE OF THE ISRAELITES	298	KINGDOMS OF ALEXANDER'S SUCCESSORS	290
CELTIC KINGDOM—457-1066	312	MEDITERRANEAN LANDS—Time of 2d Punic War	290
DISTRIBUTION OF NATIONS AFTER THE DELUGE	323	MEDO-PERSIAN EMPIRE—B. C. 529-331	295
DISTRIBUTION OF THE SONS OF CANAAN	323	ROMAN DOMINIONS—End of Mithridatic War	290
EGYPT—B. C. 3000-A. D. 640	296	ROMAN EMPIRE—2d and 3d Centuries	291
EMPIRE OF ALEXANDER	288	" " A. D. 13	289
ENGLAND—At the Roman Period	314	" " A. D. 117	289
" " Saxon	315	" " In Prefectures	289
EUROPE—Showing Barbarian Inroad	301	" " A. D. 98-117	293
" " End of 7th Century	291	" " Greatest Extent East and West	293
" " A. D. 500	302	SCOTLAND—At the Roman Period	314
" " " 800	303	" " Saxon	315
" " " 1000	304	SOLOMON'S KINGDOM	300
" " " 1200	305	THE WORLD—Hecateus' Map B. C. 520	282
" " " 1400	306	" " Herodotus' " " 450	282
" " " 1648-1789	307	" " Strabo's " " 25	283
" " " 16th Century	308	" " Eratosthenes' Map B. C. 225	283
" " " about 1810	309	" " Showing Settlements of Descendants of Noah	282
" " " After the Treaty of Vienna	310	" " Periegetes' Map	284
" " " " Berlin	311	" " Mela's Map A. D. 50	284
FEUDAL FRANCE—During the 100 Years' War	317	" " Ptolemy's Map A. D. 150	284
" " 12th Century	316	" " Showing Caucasian Nations	285
FIRST GREAT EMPIRES—B. C. 3000-500	286	" " 2d Century	287
GERMANY—1517-1618	318	" " Showing Prevailing Religions	321

DESCRIPTIVE HISTORY OF ASTRONOMY;

ITS RISE AND PROGRESS FROM THE EARLIEST AGES TO THE PRESENT TIME. PAGES 247 TO 280.

ASTRONOMICAL MAPS.

	PAGE.		PAGE.
ASTRONOMICAL CHART—Aberation, Refraction, etc.	234	STAR MAP No. 2	242
PHASES AND MOVEMENTS OF THE MOON	239	STAR MAP No. 3	243
REVOLUTION OF THE EARTH AROUND THE SUN	238	STAR MAP No. 4	244
SOLAR SYSTEM—Comparative Sizes of Planets	235	STAR MAP No. 5	245
SOLAR SYSTEM—Chart No. 2	236	STAR MAP No. 6	246
SOLAR SYSTEM—Day and Night	237	THE MOON—Its Whole Visible Hemisphere	240
STAR MAP No. 1	241		

BIBLICAL MAPS.

	PAGE.		PAGE.
Ancient Jerusalem	329	Land of Moriah	329
Bird's-Eye View of the Holy Land	330	Mesopotamia	328
Canaan and part of Egypt—Route of the Israelites	298	Palestine—Location of the Twelve Tribes	497
Canaan—Land of, time of Abraham	328	" Time of Christ	322
" Land of Promise, time of Joshua	328	Plan of the Temple at Jerusalem	329
" Showing the Captivities	327	St Paul—Voyages and Travels	326
Events of Crucifixion Week—Illustrated	326	Tribe of Ephraim	324
Half Tribe of Manasseh	324	Tribes of Judah and Simeon	324
Kingdoms of Judah and Israel	327	Tribes of Benjamin and Dan	324
Kingdom of King Solomon	327	Tribes of Asher and Naphtali	325
Judea According to Apocryphal Books	326	Tribes of Issachar and Manasseh	325
Judea Illustrating History of New Testament	326	Tribe of Zebulun	325
Judea According to Josephus	327	The Tribes—General Map of	325
Journeyings of the Israelites	328	Tribes of Gad and Reuben	329

CANADIAN HISTORY AND STATISTICS.

	PAGE.		PAGE.		PAGE.
History of Canada	11-47	Police Magistrates, Province of Ontario	60	Registration Districts, N. W. Ter.	51
County and Judicial Officers, Ontario	50	Stipendiary Magistrates, Province of Ontario	51	Division Court Clerks, Ontario	51-52
Junior Judges, Province of Ontario	50	Registrars of Deeds, Province of Ontario	51	Barristers, Attorneys, etc., Canada	55-67
Revising Officers, Province of Ontario	50	Registration Division, Province of Ontario	51	Banks of Canada	67-70
		Registrars of Manitoba	51		

DIAGRAMS.

	PAGE.		PAGE.
Comparative Size of the Countries of the World; their Population, Area, Religion and Races	93	Railroads and Telegraphs of Every Country in the World, Comparatively Shown	92
Chart showing Coalfields, Cotton and Copper Production, and amount of Alcohol in the different Wines and Liquors	90	Comparison of the Religion of Canadian Provinces	75, 82
Chart showing Corn and Orchard Products of the United States and the Domestic Production of Gold and Silver from 1793 to 1886	83	Diagram Showing Amount of Coal, Iron and Pine and Manufactured Articles Produced in the Canadian Provinces, also Freights Passing through the Canadian canals	79
Chart showing Production and Consumption of Teas, Coffee and Sugar and Drinks of all Nations	91	Imports and Exports and Duty Collected in Canada since Confederation	78
Chart showing the Wheat Crop in all Principal Countries of the World; also Comparative Area of Oceans and Seas	87	Religions of the People of Canada from last census of 1881	78
Diagram showing the Commerce, Money Circulation, Accumulated Wealth, National Debt, and Strength of the Army and Navy of all Countries in the World	94	Diagram Showing Population, etc., of Canada from Official Census of 1881	74
Production of Coal in Different Countries and Comparative Area of Lakes	86	Farm Produce of Canadian Provinces	71
		Occupied and Unoccupied Lands in Canada	71
		Nationalities and Numbers of Immigrants	71
		Value of Dominion Fisheries of 1880	71

AGE.
294
290
320
319
292
296
290
290
295
290
291
289
289
289
293
293
314
315
300
282
282
283
283
284
284
284
285
287
321

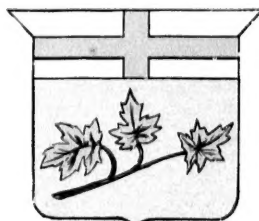
PAGE.
242
243
244
245
246
240

PAGE.
329
328
297
322
329
326
324
324
324
325
325
325
325
329

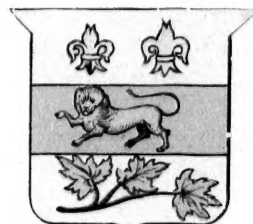
PAGE.
51
51-52
55-57
67-70

PAGE.
92
75, 82
79
78
78
74
71
71
71
71

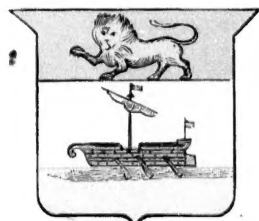
ARMS OF THE DOMINION AND OF THE PROVINCES OF CANADA.



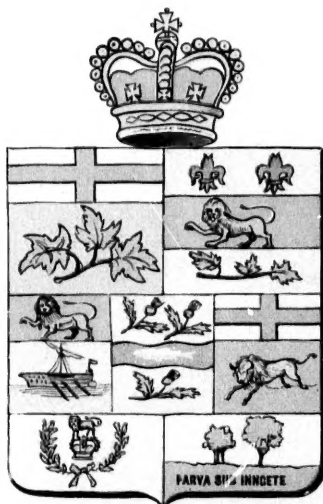
ONTARIO



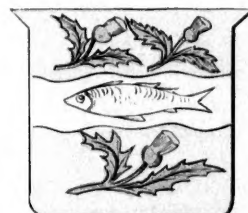
QUEBEC



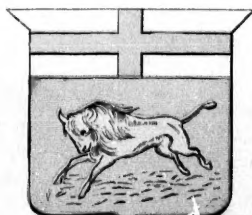
NEW BRUNSWICK



DOMINION OF CANADA



NOVA SCOTIA



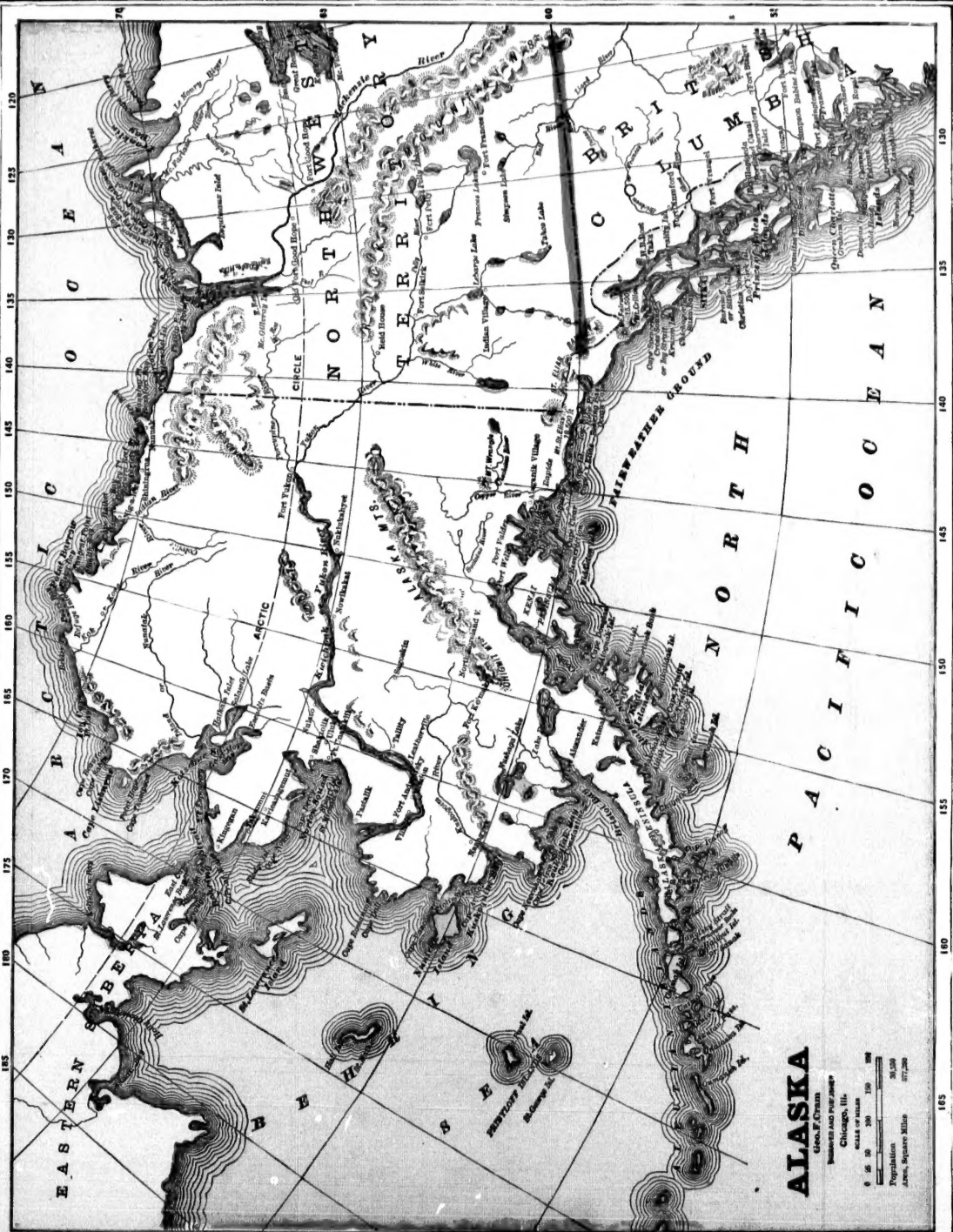
MANITOBA



PRINCE EDWARD ISLAND

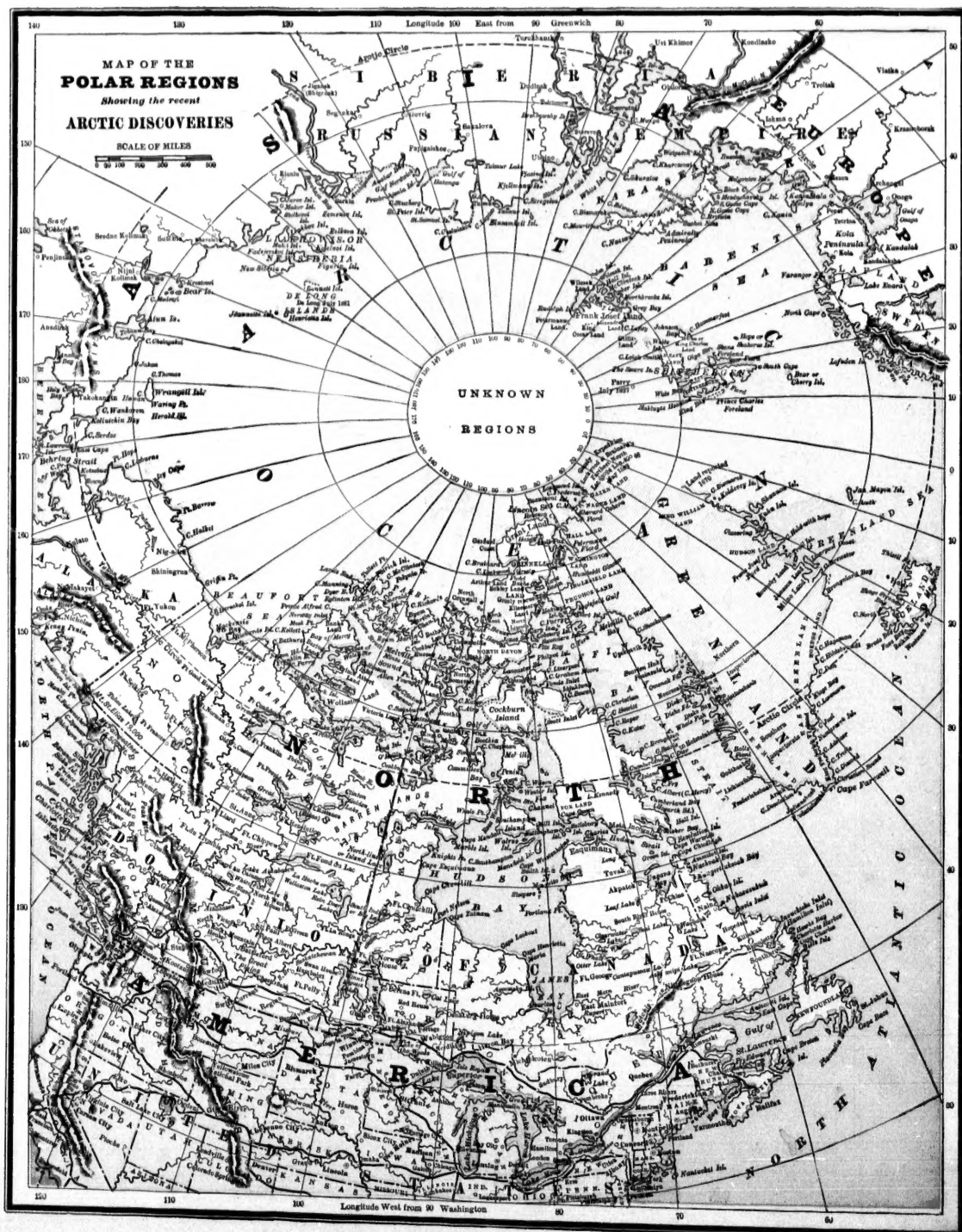


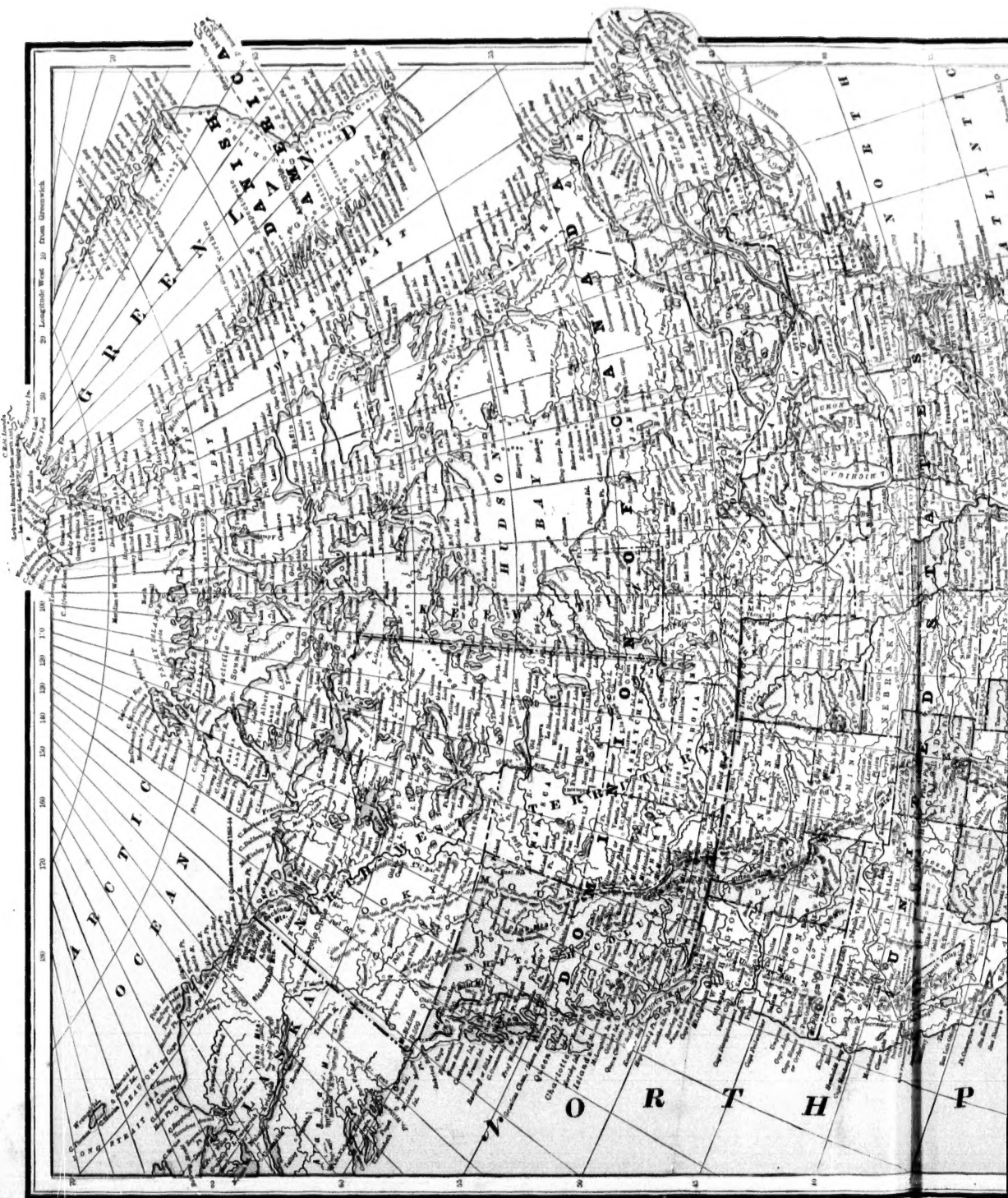
BRITISH COLUMBIA



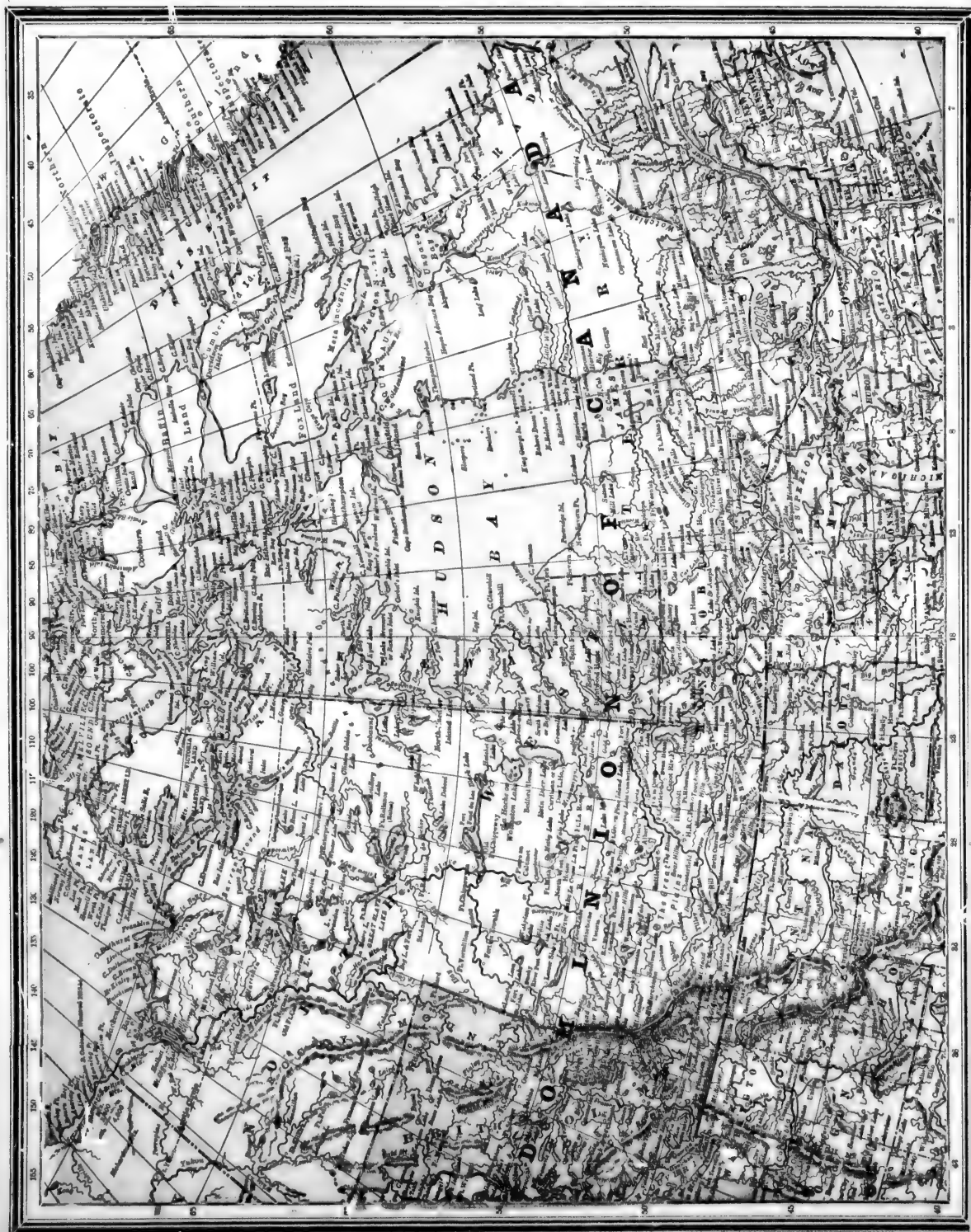
ALASKA

GEOR. F. CROMBIE
 CHICAGO, ILL.
 1897
 POPULATION 30,000
 AREA, SQUARE MILES 571,200









DOMINION OF CANADA.

PRIOR to the year 1867, the Dominion of Canada as it is now constituted, had no existence. The provinces at that time were not federated, although there was a legislative union between Upper and Lower Canada. It was because this union was not satisfactory to the large unrepresented population of Upper Canada that the scheme of confederation first took shape. When it became manifest that Lower Canada would not consent to an increase of the representatives of the other province in the united legislatures, the upper Province looked about for a remedy. Accordingly in 1864 a committee was appointed by Parliament to inquire into the affairs and political conditions of the various provinces and recommend what should be done under the circumstances. The result of the work of that committee, although the proceedings were never made public, was that the two political parties joined hands with the laudable object in view of bringing about a federal union of the whole of British America stretching from the Atlantic to the Pacific and including Prince Edward Island and Newfoundland, the latter of which, being an isolated island, was never really looked upon as a part of the British American colonies, although under allegiance to the crown of England. Delegates accordingly were appointed by the governments of Canada, Nova Scotia and New Brunswick to arrange a basis for the project, but Prince Edward Island and Newfoundland refused to send representatives. The action of the government of Nova Scotia was also unsatisfactory to the majority of the people of that province. The delegates held a conference at Quebec and the result of their deliberations was laid before the various provincial legislatures for approval. There was no opposition to the scheme in Upper Canada; in Lower Canada it carried by a very large majority; this was also the case in New Brunswick, although there was a struggle over the question at first; and in Nova Scotia the legislature refused to consent. The next step was the sending of delegates to England to have the action of the Provinces ratified by the Imperial Parliament. That body being induced to believe that confederation had not been a question at the elections in Nova Scotia overruled the wishes of the people of that Province and passed "The British North American Act, 1867," which formed into "The Dominion of Canada," the Provinces of Ontario, (Upper Canada) Quebec, (Lower Canada) Nova Scotia and New Brunswick. Since then British Columbia (in 1871) and Prince Edward Island (in 1873) have joined the union; the Province of Manitoba has been formed (in 1870) with Winnipeg as its capital, and the Northwest Territories have been purchased from the Hudson Bay Company and granted four representatives in the Parliament of the nation. Newfoundland however, has steadily resisted all overtures and remains separate and distinct "and compassed by the inviolate sea."

The Dominion of Canada under the British North American act, is practically self-governing. No taxes are paid to Great Britain, and the Governor General is the only official in the Dominion who receives his ap-

pointment from the Imperial authorities. Everything that he does is under the advice of his ministers, who are answerable to the people, the only separate authority which he is supposed to wield being the pardoning power, and even here the judgment of the Minister of Justice is his chief guide. Each province has a legislature of its own, which is competent to deal with all matters, except those left especially by the act of confederation with the federal parliament, which meets at Ottawa. The regulation of Trade and Commerce Criminal Jurisprudence, the Militia, the Fisheries and some other matters can only be dealt with by the Parliament of the Dominion. At times questions of jurisdiction between the Local Legislatures and the Federal Parliament have given rise to appeals to the courts, and have been frequently brought forward in political campaigns for party purposes.

The completion of the line of the Canadian Pacific Railway, from ocean to ocean, which took place in the summer of 1885, is an undertaking which should have the effect of popularizing confederation. It has however in Manitoba, bred a feeling of discontent, as the inhabitants of that province allege that the great railroad has been given too much of a monopoly by the Government, and are anxious to construct lines of their own to the American frontier. On the other hand, the Province of British Columbia has good reason to rejoice at the building of the line, as now steamers are being run from China and Japan to their ports, where the cargoes are unloaded and shipped by rail to the great markets of the continent. It seems probable, moreover, that the British Government will charter a line of steamships to connect with the Canadian Pacific Railroad at Vancouver, and thus establish a route for the transportation of troops and supplies to India, independent of the Suez canal.

THE BOUNDARY LINE.

The boundary line between Canada and the United States commences at a point near the mouth of the River St. Croix, in New Brunswick, where a monument has been erected; then follows the waters of that stream until the St. John is reached; from thence it goes along the middle of this river to the mouth of the St. Francois river; from there the line takes an irregular course until it reaches the 45th parallel of north latitude in the Province of Quebec, and thence it follows to St. Regis on the St. Lawrence; westward from St. Regis the boundary line is the middle course of the St. Lawrence and of Lake Ontario, Niagara River, Lake Erie, Detroit River, Lake St. Clair, River Ste. Clair, and Lakes Huron and Superior. From the head of Lake Superior the line follows the water courses to Lac-des-Bois, and from thence by the 49th parallel to the Pacific ocean. With the exception of the territory of Alaska, which was purchased from Russia by the United States, the whole of the territory north of this line constitutes the Dominion of Canada.

CLIMATE.

The climate of Canada has constantly been misrepresented in European countries. It has been characterized as a country of perpetual snow, where the people

habitually wrapped themselves in furs and blankets to keep out the intense cold. When it is recollected that the northern limits of the Dominion border on the arctic circle, these statements seem to contain some truth; but the fact is, that the climate of the settled portions of Canada, which includes all the Provinces, is a fine one. The winters are cold but healthy, and the frost does not interfere with the growing of splendid crops. Orchards thrive, producing all kinds of fruits, and in some sections peaches and grapes are grown well in abundance. Potatoes, turnips, carrots, melons, tomatoes, peas, beans, and all kinds of garden stuff grow in great quantities. To judge by the health of the people, it would indeed be safe to say that the climate of Canada is well adapted for the production of a vigorous and long-lived people.

AREA OF CANADA.

The area of Canada is greater than that of the United States, and is nearly equal to the whole of Europe. The following is a statement of the size of the various Provinces in square miles, as shown by the Dominion census of 1881: Prince Edward Island, 2,133; Nova Scotia, 20,907; New Brunswick, 27,174; Quebec, 188,698; Ontario, 101,733; Manitoba, 123,200; British Columbia, 341,535; Territories, 2,665,252, making a grand total of 3,470,392 square miles of territory. Out of this 586,225 square miles are timbered and prairie lands suitable for the growth of wheat and other grains, and a further tract composed of 927,000 square miles is fairly well timbered and will grow grasses and hardy varieties of grains. Altogether there are about 375,184,000 acres of arable land which could be brought under cultivation beyond the limits of the organized provinces and the greater portion of this tract would produce wheat. The wheat zone covers 1,300,000 square miles, the grasses and coarser grains 2,300,000 square miles and the maize 500,000 square miles.

ITS RESOURCES.

Besides her agricultural resources Canada possesses immense forests, mineral deposits of gold, silver, copper, iron and other metals of vast extent and an abundance of coal. It is admitted by the official reports of the United States that Canada produces far more wheat, barley, peas and oats to the acre than any part of the Republic, and as a pasture or grazing country the contrast is even more strongly in favour of the young Dominion. As a stock raising country Canada has a record which may be pointed to with pride. The finest stock of all kinds is being constantly imported with the natural result of producing the best grades of horses, cattle, sheep and hogs. The many stock breeding associations which from time to time have been organized in Canada have done admirable work, the results of which can be seen at any of the many fall exhibitions held throughout the provinces.

THE GREAT LAKES.

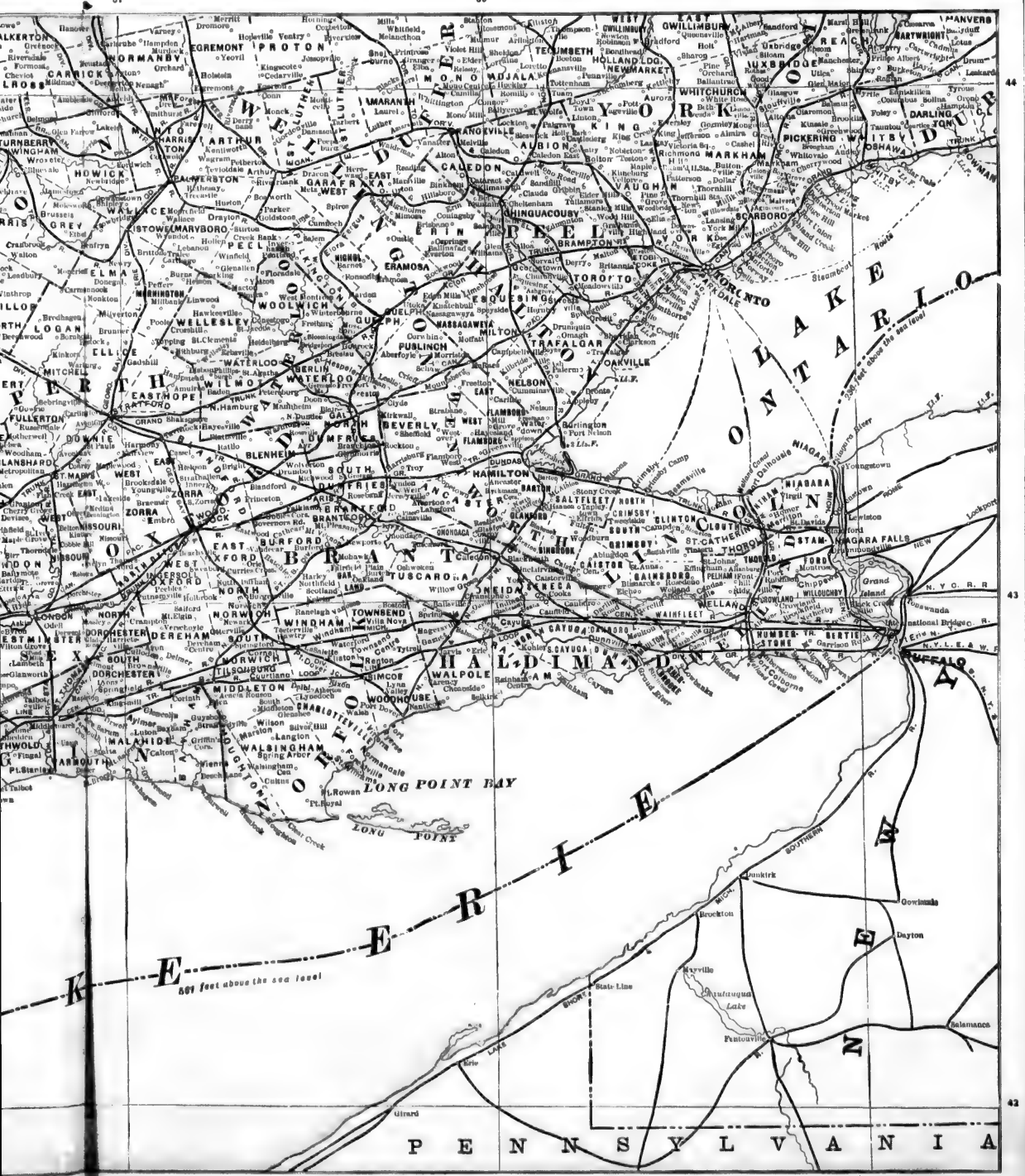
The great lakes of Canada are Ontario, Erie, Huron, and Superior, but there are numbers of others more or

SOUTH-WESTERN PART
OF
ONTARIO

Geo. F. Cram, Engraver,
Chicago, Ill.

SCALE OF MILES
0 5 10 20 30 40 50





DOMINION OF CANADA.

less remote from civilization. Of late years the destruction of fish in these lakes has been very great, in consequence of which the government has carried on for some time, a system of artificial incubation, by which means young fry are hatched with which to replenish the waters. In the lakes of the North however, and where there are but few settlers, the lakes and streams teem with fish of all kinds.

POPULATION.

The population of the Provinces which now form the Dominion of Canada in 1891 was 3,207,630. According to the census of 1881 the total population of the Dominion was 4,224,810, distributed as follows: Ontario, 1,923,228; Quebec, 1,350,927; New Brunswick, 321,293; Nova Scotia 440,572; British Columbia, 49,450; Manitoba, 65,934; Prince Edward Island, 108,891; Territories, 56,446. It is estimated that the present population of the Dominion is, as accurately as can be calculated, about 5,000,000.

POLITICAL MATTERS.

Ever since confederation, with the exception of five years during which Hon. Alex. Mackenzie was in office, Sir John A. Macdonald, leader of the Conservative party, has been Premier of the Dominion. In 1878, having been out of power for five years, Sir John pre-empted to the electors, the country then suffering under commercial depression, the theory of what is now known as "The National Policy." The result was that his party was returned to office by an overwhelming majority, and he has held the reins of government ever since. No more complete proof of the virtual independence of Canada could be given than to point to the fact that under the national policy she has placed a high prohibitory tariff against the productions of the mother country. There is a growing feeling in Canada however, that a commercial union between the two great English speaking nations on this continent might benefit both. But there is no doubt that whatever the people decide upon they will have, irrespective of the views of either of the political parties. This question must of course be dealt with by the Dominion Parliament, which has exclusive control of the customs and excise revenues, and agreed at confederation to pay to each Province an annual subsidy of 80 cents per head of the population besides a yearly sum to the several Provinces as follows:—Ontario, \$80,000; Quebec, \$70,000; Nova Scotia, \$60,000; New Brunswick, \$50,000; Prince Edward Island, British Columbia and Manitoba have since then been added to the list and Nova Scotia has been granted an additional amount. New Brunswick was also at confederation entitled to receive, besides the above amount, \$63,000 per annum for ten years.

MILITIA SYSTEM.

The militia system of Canada, all things considered, is a good one although the government has not given the citizen soldiery the substantial backing or the moral support which they deserve. The infantry consists of 96 battalions, all of which vary in strength. Besides these are a number of independent companies scattered through the less settled districts. The Dominion volunteer cavalry number 8 regiments, including several of a provisional character, and there are also a number of independent troops. The artillery is represented by about 17 field batteries, besides 29 garrison batteries or brigades. Three companies of engineers are also organized; one in Quebec, one in New Brunswick, and one in Prince Edward Island.

PERMANENT CORPS.

Besides the active militia there are in Canada a number of permanent corps representing the different arms of the service which might be looked upon as a "regular army" on a small scale. These consist of "A" Battery Royal School of Artillery, (Kingston), Commandant Lt. Col. W. H. Cotton; "B" battery (Quebec), Commandant Lt. Col. C. E. Montzambert;

"C" battery (Victoria, B. C.) Commandant Lt. Col. J. G. Holmes; "A" company School of Infantry, (Fredericton, N. B.), Commandant, Lt. Col. G. J. Maunsell; "B" company, (St. John's, Que.), Commandant, Lt. Col. G. d'Orsonnens; "C" company (Toronto, Ont.), Commandant, Lt. Col. W. D. Otter, "D" company (London, Ont.), Commandant, Lt. Col. Henry Smith; School of Mounted Infantry, (Winnipeg), Commandant, Lt. Col. J. B. Taylor; Cavalry School Corps, (Quebec), Commandant, Lt. Col. J. F. Trumbull. These various corps consist of about 100 men each, who act as garrisons at their different posts, and also give instructions to militia officers and men who may desire to take a military course. The practical necessity of an efficient militia system was fully demonstrated in the spring of 1885 when the half breed rebellion broke out in the Northwest. It was no small matter to transport upwards of 6,000 men with provisions and munitions of war an immense distance into a country where no railroads existed. Yet this was done, and with marvelous rapidity. The force was made up from all over the Eastern Provinces of the Dominion, and from the Province of Manitoba. Some of the men travelled from Halifax to the valley of the Saskatchewan, and a glance at the map will show the vast distance from which many of the volunteer regiments came. The expedition, too, was commenced in March when the severity of the winter was yet unbroken, and the men suffered great hardship in traversing the northern shore of Lake Superior. Nearly 700 alone were sent from Toronto, including 250 men of the Queen's Own Rifles, and 250 men of the Royal Grenadiers, two of the crack corps of the Dominion. In suppressing the rebellion, great credit is also due to Canada's handful of regulars, who were ever at the front where fighting was to be done, and who set a worthy example to their brethren of the militia.

The commander of the militia is always a field officer in the Imperial army, that post being at present filled by Sir Frederick Middleton, who was chief in command of the Northwest Expeditionary force. Since the rebellion of 1885, the Canadian Pacific Railway which was then only completed in sections, has been finished, and the transportation of troops to the Northwest made comparatively easy should such an unfortunate necessity arise in the future.

TRADE AND RAILWAY STATISTICS.

For the year ending June 30, 1887, the total value of exports for the Dominion was \$89,515,811, and of imports \$112,802,236, and the amount of duty paid was \$22,409,705. The same figures for 1888, the first year after confederation, were: Exports, \$57,567,988; Imports, \$73,459,644; duty paid, \$8,812,482. The total railway mileage of the Dominion, on June 30, 1886, was: Railways actually in operation, 10,667 miles; under construction, 1,577; total capital raised for railway purposes from various sources, \$663,370,144.

IMMIGRATION.

If all the immigrants from Europe who land in Canada remained there, the country would soon be settled from ocean to ocean. But this is not the case, for the vast numbers that pass through Ontario are merely on their way to the Western States. There is an obvious reason for this. These immigrants come from old countries, where the monarchical form of government prevails, and knowing only that Canada belongs to the British Empire, without being aware of the fact that she makes her own laws without interference from Great Britain, they prefer to settle under the flag of the adjoining Republic. Many of these immigrants, besides, come from Germany and other countries on the continent of Europe, and are accustomed to a holiday on Sunday, and to unrestricted liquor laws at all times. If they go to the Northwest territories, they find themselves deprived of their *lager* altogether, and even if they settled in Manitoba, they

can only enjoy it under stringent regulations. The laws regarding the Sabbath are undoubtedly looked upon by foreigners as oppressive, and they do not hesitate, when they find out the state of affairs in Canada, to cross the border line into Minnesota or Montana. But whatever may be the cause, it is universally admitted by the press and the public, and the statement is borne out by statistics, that an immense exodus of settlers has taken place from the Canadian Northwest into the United States. This seems a pity, but it is not to be wondered at, when it is considered that few people care to cross the ocean in search of freedom, and find themselves under more social restrictions than encompassed them in the land of their nativity. It is alleged, however, on the other hand, that it is better to have a limited number of settlers in the country, who are in sympathy with moral reform, than a large number who claim the right of private judgment in such matters.

MARINE MATTERS.

One of the most important industries of Canada is ship-building, and this interest has steadily grown and prospered since confederation. In this respect Canada is the fourth nation in the world, with good prospects of being third. The lighthouse system on Dominion waters is very extensive, and is being constantly enlarged. The lighthouses are divided into six general divisions, viz: the Ontario division, which embraces the lights and light-ships between Montreal and the boundary line between Ontario and Quebec, as well as those on the Upper Lakes, the River St. Lawrence westward from Montreal, and the Ottawa River; the Quebec division, comprising the St. Lawrence below Montreal, the Gulf, the Straits of Belle Isle, the coast of Labrador, and the lights maintained by the Dominion on the northwest coast of New Foundland; and the four divisions, known as the New Brunswick, Nova Scotia, Prince Edward Island, and British Columbia divisions. The most important of all these is the Nova Scotia division.

FISHERIES.

The fisheries of the Dominion are of immense value, and are practically inexhaustible. It is therefore, little to be wondered at, that the United States fishermen are anxious to obtain the right to fish off the shores of Canada without being impeded by any regulations as to bait, etc. The history of the fisheries dispute with the American government, which is as yet unsettled, is too long to recount here, and it is sufficient to say that what the fishermen of that country require, is leave to obtain bait and ice in Canadian ports. This the Canadian government object to allow, as it would permit of the Americans bringing to their markets Canadian fish free of duty, while that caught by Canadians would be shut out. The great proportion of the American people are, without doubt, in favor of the matter being arranged on a fair and equitable basis, irrespective of the squabbles taking place among the fishermen themselves. The fact that, by what is known as the Washington treaty, Canada received from the United States the sum of \$5,500,000 as compensation for the use of its fisheries, goes to show that in this dispute Canadians are not altogether in the wrong.

The consumption of oysters in Canada is very large, but only a portion of the supply comes from native sources. There is no reason however, why the oyster beds of Canada should not be greatly enlarged by artificial means. In Quebec, Nova Scotia and New Brunswick, the fish which are mostly largely caught are salmon, codfish, herring, mackerel and lobsters. In Ontario, salmon trout and whitefish are the chief varieties, although in some sections, muskellong and sturgeon are captured in considerable quantities.

CANALS.

Between the Straits of Belle Isle, to the head of Lake Superior, a distance of 2,384 miles, there are 71½ miles of canals, built to overcome difficulties of navigation, which otherwise would be insurmountable. There

DOMINION OF CANADA.

are also smaller canal systems between Montreal and Ottawa, on the Ottawa River, and between Ottawa and Kingston. Lake Champlain is also connected with the St. Lawrence system, and in Nova Scotia, St. Peter's canal crosses an isthmus of half a mile, connecting St. Peter's Bay on the southern coast of the island of Cape Breton with the great and little Bras d'Or lakes, which have a natural outlet to the Atlantic ocean. The Welland canal, which connects Lakes Erie and Ontario on the Niagara River, has recently been enlarged and improved, involving a large outlay of money. A canal at Sault Ste. Marie on the Canadian side will certainly be constructed before very long, as its want is being severely felt and if troublesome times again arose in the Northwest, it would be available for the transport of troops, the American Government being unwilling to allow their canal to be used for that purpose.

POSTAL SYSTEM.

The postal system of Canada has been much improved of late years, although the last steps taken by the United States, the reduction of the letter postage to two cents, which took place between four and five years ago, has not yet been followed. The money order system was in 1873, extended to Manitoba and British Columbia, and the introduction of the postal card system, a great convenience to the public, took place about the same time. The free delivery of letters in Canada in large towns and cities has been inaugurated and operated for some years with perfect success, and since 1875 extra postage to and from the United States has been abolished. The arrangements for paper, book, parcel and sample post throughout the Dominion are of a very complete character, and a great variety of articles can be sent by these means. The money order system is also of great utility to the public. The saving banks which for some years have been run in connection with the post offices are very popular institutions and are patronized largely.

THE LAND SYSTEM.

In the Provinces of Ontario, Quebec, New Brunswick, Nova Scotia, Prince Edward Island and British Columbia, with the exception of a portion of the last named province granted to the Dominion for the Canadian Pacific Railway, the lands belong to the various Provincial Governments. Free grants are in several Provinces given to immigrants, and Government lands in most localities can be purchased very cheaply by prospective settlers.

In Manitoba and the Northwest Territories, the land for settlement is surveyed as follows: It is first laid out in blocks of 12 miles square, the outlines of each block being marked by monuments every mile and a half. These blocks are sub-divided as occasion requires into four townships of six miles square each; these into thirty-six sections of one mile square or 640 acres each, and each of such sections, into quarters of 160 acres or half a mile square.

Northwest land may be purchased at from \$1 to \$5 per acre, according to its location, or it may be obtained by actual settlers on free grants. To obtain a free grant, an applicant must be a British subject either by birth or naturalization, and 21 years of age. He must then make an application to the land officer to be entered for a free grant of one-quarter section of 160 acres, or for any less quantity for a homestead, and then by certain occupation and improvements thereof, without having sold the land, or any portion thereof, he becomes entitled to a deed from the Crown which gives him the absolute right on "fee simple." No sale of more than a section of 640 acres will be made to any one person in Manitoba or the Northwest. There are also rights of pre-emption in the Northwest by which any person who is a British subject by birth or naturalization who builds a dwelling upon and inhabits and improves any quarter section of 160 acres, has the right of pre-emption, that is to say, by entering his application with the Land officer, and paying from \$2.00 to \$2.50 an acre, he

can obtain a patent therefor. The claimant however, before entering his application, must make affidavit before the Land officer that he has not previously exercised his right of pre-emption, and he must also by his own affidavit together with the testimony of two witnesses prove the settlement and improvement of the land in a manner satisfactory to the Land officer. But the government will not recognize any assignment of the pre-emption right prior to the issuing of the patent. Lands allotted to the Hudson's Bay Company, lands reserved for Schools, and woodlands set apart for timber purposes, are reserved from the operation of the foregoing regulations. It is impossible in so limited a space to give any minute explanation of the Dominion land regulations, which besides are undergoing alterations from time to time. Intending settlers will do well therefore, to apply to the Government officials direct for the very latest information.

WHO SHOULD IMMIGRATE.

The question is often asked by persons from the old world, "Who should immigrate to Canada?" The best way to answer this question is to define in the first place who should not emigrate. Mechanics should not, there are too many here now; clerks, book-keepers and others of that class should not, and the idle, the vicious, and those having no capital, should by all means stay away, as by coming to Canada, they may find themselves worse off instead of better. But small farmers, with a moderate amount of money, say from \$500 to \$1,000, can with industry and intelligence attain very comfortable positions by taking up lands in Canada. Farmers from Great Britain who come to settle had better however acquaint themselves with the methods of agriculture on this side of the Atlantic before investing all their capital. It should be stated frankly that the ordinary labour market of Canada is over-stocked and, although work can be had at certain seasons of the year, yet in winter it is scarce and many families all over the country have to depend upon public charity. The truth is that no one should come to the Dominion unless he has ready money or the certainty of employment before him.

Many public works are constantly going forward in Canada, and in Toronto alone, new parliament buildings, a combined court house and city hall, several large and costly banks, insurance buildings and colleges and a great variety of other dwellings will be put up within the next few years, but mechanics and labourers from other countries, would do well to bear this in mind that there is no more work than is required for those already on the ground, and that a plethora of labour means the crowding out of the latest comers. It should be added that what is true of Toronto is true of the whole Dominion, and those whom steamship agents and others seek to induce to come to Canada for the sake of the commission which they can make out of them, should take warning in time.

ONTARIO.

Of all the Provinces in the Dominion of Canada, Ontario possesses the greatest attractions for the English-speaking race. In Quebec, a knowledge of the French language is necessary, if one desires to converse freely, as the greater portion of the population speak English very little, or not at all. Ontario however, was originally settled by English, Irish, Scotch, and Germans, who have made it what it is—the richest, most populous and most influential province in the Dominion. Ontario is bounded on the east by the Province of Quebec; on the south by the mid-waters of the St. Lawrence or National boundary line, and the great Upper Lakes; and on the west and north by the line which separates it from the Province of Manitoba and the great Northwest. It has an area of about 80,000,000 acres of land, the greater portion of which is fertile, and the rest abounds in mineral products and

forests. The great lakes on its southern and western boundaries are Lakes Ontario, Erie, St. Clair, Huron, Superior, and Georgian Bay, which cover an area of 80,000 square miles, with a total length of 1,685 miles. The system of inland navigation eclipses any other in the world. Immense steamers traverse these bodies of water, capable of accommodating great numbers of passengers and large cargoes of freight. By the canal system, vessels can pass from Thunder Bay, at the head of Lake Superior, to the Atlantic ocean, by way of the River St. Lawrence, descending through a difference of level amounting to about 600 feet. face of the globe.

POPULATION AND SOIL.

The population of Ontario in 1881 was 1,923,228, and it is estimated at about 2,000,000 at the present time. The soil varies considerably, but a great proportion of it is well adapted for agricultural purposes. About fifty miles north of Kingston, Belleville, and other places on the north bank of the St. Lawrence, the land is very rocky, and shows so much iron ore that compasses are affected thereby. Further to the west however, stretches a magnificent tract of country, and that portion of Ontario which lies west and south of Lake Simcoe, is the very garden of Canada. It would be a mistake to suppose however, that this section contains all the fertile land, for portions of the East, between Lake Simcoe and the Rivers St. Lawrence and Ottawa are also of great agricultural importance. It must be borne in mind too, that parts of Ontario are not as yet well known, and but little settled and only quite recently has their exceeding fertility been brought before the public through the samples of their products exhibited at fairs, held in the older sections. At a recent Industrial Exhibition held in Toronto, an exhibit was shown from Halliburton which astonished all who saw it. Halliburton is far to the north of Peterboro', in a new and comparatively rough country, and yet the roots and cereals were of splendid quality, and the fruit was also remarkably good. Moreover it was quite evident, to those who saw the display, that the crops of that locality could not be seriously affected by the winter, which of course, is more severe than in the southern portion of Ontario.

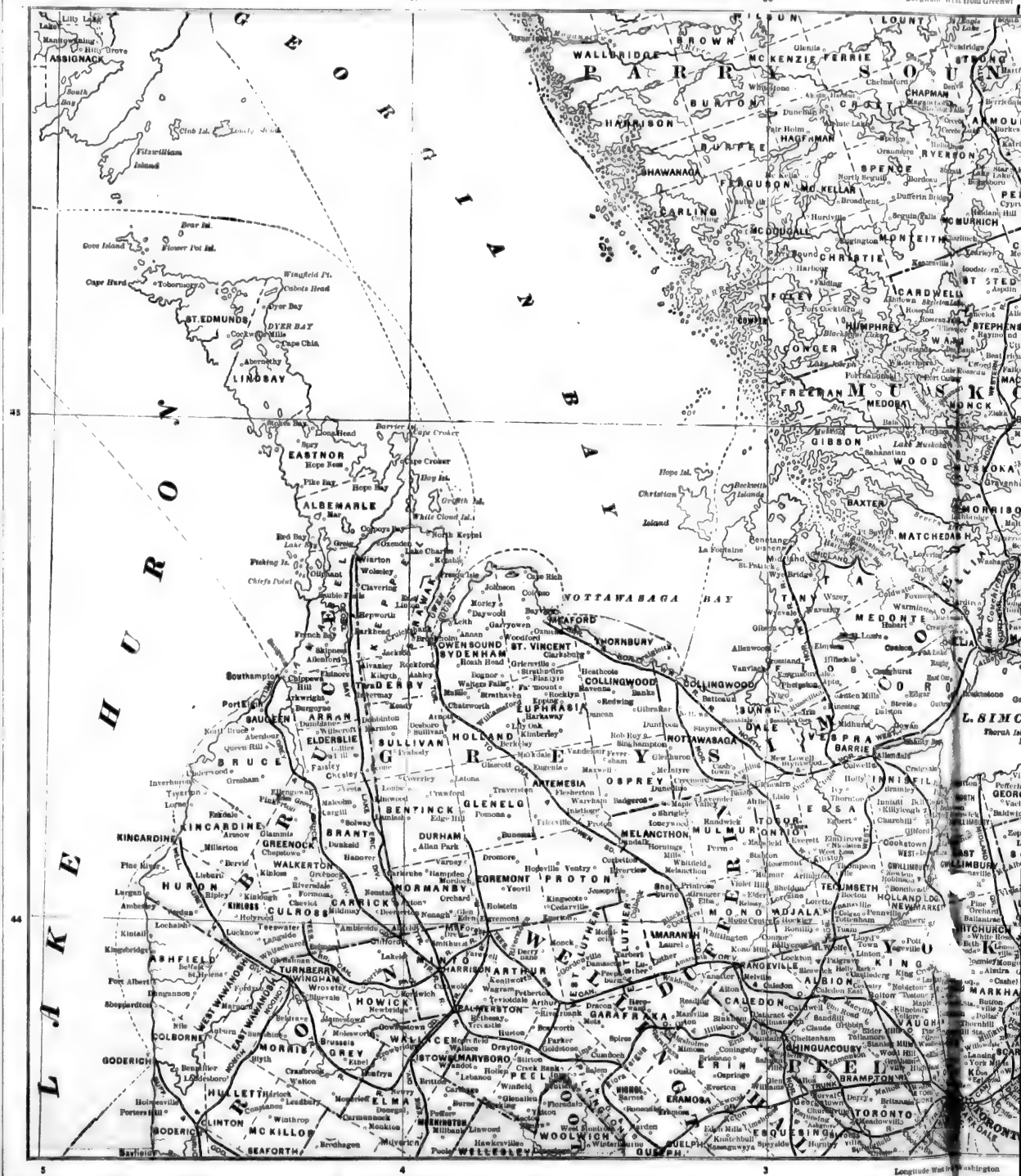
The average yield of wheat in some portions of Ontario is from 22 to 30 bushels to the acre, very much depending upon the husbandry used. Sometimes as high as 40 or 50 bushels have been secured, where the land is new. Barley is an extensive crop, and is also remunerative, which may be said with equal truth of peas and oats. Indian corn too, is largely raised in the warmer sections. Potatoes, turnips, mangels, carrots, and roots of all kinds are extensively cultivated all over the province, and thrive well. Flax is another crop which can be raised to advantage.

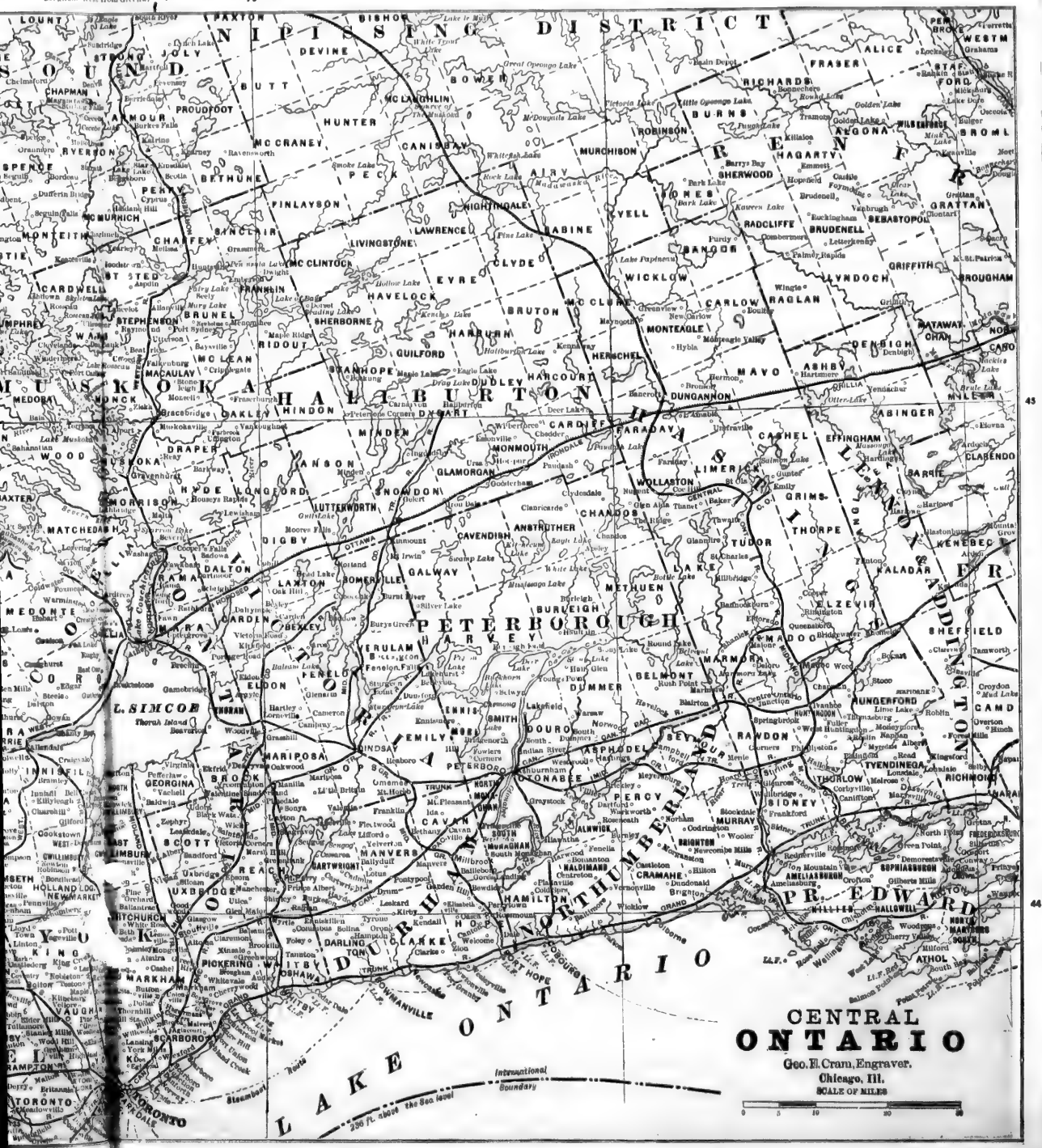
CHEESE-MAKING.

The cheese-making industry in Canada is of quite recent growth. Cheese was always made, more or less, since the settlement of the country, but what a different article it was from the splendid products that have won for Canada honours all over the world. Formerly lovers of fine quality of cheese used extensively the exports of the English markets; but now all this is changed, and "Canadian Stilton" is well worthy of the distinguished name it bears. This reform has been brought about by the establishment of an efficient system of factories throughout the country, to which the farmers contribute their milk on the co-operative plan. The scheme has worked admirably, and, although cream is not as plentiful on the tables of the farmers as it used to be before most of the milk went to the cheese factory, yet it has been a change for the better in more ways than one.

AGRICULTURAL SOCIETIES.

There are in Ontario about 300 societies organized for the promotion of agriculture, horticulture, mechanical art, which are subsidized by the Government to the





DOMINION OF CANADA.

extent of about \$70,000 or \$80,000. This sum is distributed according to the amount which the societies raise by their own efforts. Many of these societies have the primary object in view of holding annual exhibitions, at which substantial premiums are offered for highly bred stock, as well as a vast number of other lines of importance to the agriculturist. Besides these, there are some associations which devote all their energies to the breeding of fine grades of cattle, horses, sheep and hogs, such as "The Clydesdale Association," "The Ayrshire Breeders Association," "The Shorthorn Breeders Association." Stud-books and herd-books are also carefully compiled and issued, and no Canadian breeder can claim a bogus position for his stock without a certainty of being ultimately detected.

In agriculture, Canada is fully up to the standard of the United States and in some respects many claim superiority. The cash value of the farms of Ontario, per head of the population, is greater than that across the border. The following facts have, also in this connection, been demonstrated beyond a doubt, by figures which are incapable of wrong:—That the capital invested in agricultural implements is greater in Ontario than in the States, in proportion to the land cultivated; that the value of agricultural implements manufactured in Ontario does not fall very much behind the value of agricultural implements manufactured in the States, in proportion to the population; that in proportion to the number of her people, Ontario produces more than three times as much wheat as the United States; that she is greatly ahead, even of the Western States, as a wheat-producing country; that of the eight leading staples of agriculture—wheat, corn, rye, barley, oats, buckwheat, peas, beans and potatoes—she has produced 55.95 bushels for each inhabitant, while of the same articles the United States produced only 43.42 bushels for each inhabitant; that, excluding Indian corn from the list, she produced of the remaining articles 54.34 bushels for each inhabitant, against 16.74 for each inhabitant produced in the United States; that, in proportion to population, she has more capital invested in live stock than the United States; that for every 100 of the population, Ontario owned 27 horses, and the States only 20; that for every 100 inhabitants, Ontario owned 32 milch cows, and the States only 27; that for every 100 inhabitants, Ontario owned 84 sheep, and the States only 71; and that of live stock, in the number of hogs only was she exceeded in number, according to the population, by the United States. Also, that she produced 19.22 pounds of butter for every inhabitant, while the United States produced only 14.62; that she produced 2.92 pounds of wool for each inhabitant, while the United States produced only 1.92; that in ten years she increased her annual production of butter by 67 per cent., while the increase across the line was only 46½ per cent.; and that she increased her production of wool 40 per cent., while the United States increased their production only 15 per cent.

MINERAL WEALTH.

Reference has been already made to the mineral wealth of Canada, but this, although very great, is almost entirely undeveloped. With the view of building up the iron industry as other industries have been built up, the Finance Minister of the Dominion, Sir Charles Tupper, during the last session of parliament announced a policy which somewhat took the country by surprise. It was a large and almost prohibitive increase in the duty on that useful metal. This duty presses most heavily on pig iron, as hitherto smelting has scarcely been carried on at all in Canada. What the promoters of the project and those who are believers in the National Policy look for is an influx of capital from the United States or England, and the establishment on a large scale of smelting works, which will render the importation of pig iron unnecessary. On the other hand, the advocates of free trade allege that when the pig iron is produced from the ore, the manu-

facturers will take advantage of the high tariff and charge consumers a higher price than they would have to pay for the imported article. The fact, however, that Canada possesses almost unlimited quantities of iron no one disputes, and probably all parties would like it made use of. The principal region for metal is north of the river St. Lawrence, at a distance of 50 or 60 miles, and also north of the Muskoka region along the south shore of Lake Superior. In the country between Georgian Bay and the Ottawa river iron, copper, lead, plumbago, antimony, arsenic, manganese, heavy spar, calc-spar, gypsum, plaster of paris, a fine quality of marble and building stone are found near the surface in large quantities. Mica is also found in this region and can be worked profitably. Gold also exists there, but has not yet been discovered in paying quantities. On the north shore of Lake Huron are situated the famous Bruce copper mines, and on the shores of Lake Superior, particularly near Thunder Bay and Silver Islet, rich veins of silver have been discovered.

Ontario produces an immense amount of petroleum which is pumped out of wells in some sections which seem to be inexhaustible. When oil was first discovered in Ontario in 1860, great excitement prevailed. Obscure little towns and villages that had never before been known outside the limits of their county, at once sprang into prominence, and fabulous prices were asked for land upon which it was thought petroleum was likely to be discovered. Even now a trip through certain sections will show here and there throughout the country the abandoned "derricks" where oil was bored for and not found, and where thousands of dollars were sunk in the feverish haste to become rich. The first wells were struck at Oil Springs, in the county of Lambton in 1860, and by March, 1863, these had yielded over 4,000,000 gallons. Bothwell in the county of Kent, and Petrolia in Lambton, also became great oil producing centres, and have continued so ever since. Refineries have been erected in London and other places and the trade has not reached very large proportions. In the neighbourhood of Goderich, and in fact all through the county of Huron, salt has been obtained from brine pumped from wells sunk to an immense depth, and the quality of this product is excellent. There are also in existence in Ontario large deposits of peat, and the digging and manufacture of this article of fuel is being carried on successfully by a number of companies.

MANUFACTORIES.

Since the introduction of the National Policy in 1878, manufactories of all kinds have sprung into existence. The reason of this is obvious, it does not pay to import. Very many of these manufactories have been started by Americans with capital from across the line, and these persons would be the last to welcome commercial union, in fact they would oppose it strenuously. There is scarcely a branch of trade which has not been effected by the National Policy and although American goods are still imported in considerable quantities, yet the bulk of the wants of the people are supplied from native sources. Quite recently a New York firm which does an immense business in the United States, opened a branch establishment in Toronto for the manufacture of smoking and plug tobaccos. The effect of a prohibitive tariff is also shown in the sugar industry, the Messrs. Redpath of Montreal, practically controlling the trade of the Dominion in this article. Boots and shoes for both sexes and rubber goods of all kinds are manufactured extensively in both Montreal and Toronto. Even in such lines as that of sauces, pickles and confectionery, the influence of protection is strongly felt, although the shutting out of English pickles, Worcestershire and Anchovy sauces, and New York bon bons has only been partially successful, the imported articles being so far, much superior to the domestic. When the protective tariff first came into operation the cotton trade became greatly demoralized and prices

went up. This condition of affairs however did not last, and after a time this industry became established and prices again dropped, although this class of goods can never be as cheap under protection as under a revenue tariff.

Ontario possesses unlimited water-power for manufacturing purposes, and steam is also used a great deal. Among the articles produced are cloth, linen, paper, cotton goods, furniture, lumber, flax, iron and hardware, woodenwares, steam engines of various sorts, agricultural implements, cigars, tobacco, boots and shoes, rubber clothing and hose, wooden ware, trunks and valises, twines and ropes, leather belting, pianos and organs, etc. An organization known as "The Manufacturers Association," looks after the united interests of all these various industries, and when the Government or the public are supposed to take any position inimical to their interests, this organization promptly lets its voice be heard. A question which just now is attracting much attention on both sides of the line, is that of commercial union, and some remarks in regard thereto may be appropriately made.

COMMERCIAL RELATIONS WITH THE U. S.

In April 1874, Sir Edward Thornton and Hon. George Brown, joint plenipotentiaries of Her Britannic Majesty, laid before the United States Government at Washington, a "Memorandum on the Commercial Relations Past and Present of the British North American Provinces with the United States." By this it was shown that in the interval from 1845, when a more liberal policy gave encouragement to intimate commercial relations between Canada and the United States, till 1853, the aggregate export and import trade between the two countries rose from \$8,674,291 to \$29,091,300, and at the same time a large amount of the import and export traffic between Great Britain and the Provinces was carried in bond over the canals and railways of the United States. The Reciprocity Treaty was negotiated by the late Earl of Elgin, as Governor-General of Canada, and signed on June 8th, 1854, and was abrogated in 1896. In the latter year of its continuance the Rebellion in the States gave a great advantage to Canada, so that in that period the exports to the States amounted to \$34,714,283. Yet even then the balance of trade continued to be in favour of the United States, and under the operation of the treaty New York, Portland, Boston and other American seaports were so largely used for the trade of the British Provinces that the transportation traffic sent to and brought from foreign countries in bond over the railways and canals, and in the ocean ships and steamers of the United States became an important element of revenue to their chief lines of transport. The effect of this was to give American statesmen an exaggerated idea of the value of such facilities to the British Provinces and even to lead them to believe that the sweeping away of the Reciprocity treaty would be sufficient to create a desire for annexation. This however, did not prove to be the case and Canada by building the International railway at a cost of \$20,000,000, and by subsidizing ocean and steamship lines and enlarging her canals gave a great stimulus to industries of all kinds. The result of this policy was that seven years after the repeal of the treaty, the foreign commerce of the country had reached the sum of \$235,301,203, a large amount for a population of 4,000,000.

Protection has now been in operation since 1878, and as it has been the issue now in three general elections and has been endorsed by the people it has assumed the aspect of a fixed policy. This being the case the United States have lately broached the subject of Commercial Union which is being widely discussed in both the American and Canadian press. Whatever the result of this agitation may be, it is clear that no government can afford to ignore the voice of the people, and if Canadians want commercial union with their American cousins, and are willing to meet them halfway, the protective tariff will be swept to the winds.

DOMINION OF CANADA.

The most determined opponents of such a change will be found in the manufacturers, who would undoubtedly suffer at first whatever the ultimate result might be.

RAILWAYS OF ONTARIO.

Travelling by stage is now almost a thing of the past in Ontario, although a few small places here and there keep up communication with the nearest railway town or city by such means. These stages are however nothing more than covered wagons, and in no way resemble the substantial four and six horse coaches with seats on the roof for outsiders and "boots" for baggage, that were seen on Canadian highways before the shriek of the locomotive was heard in the land. But the old coaching days have gone, and Canada is now netted with railways, although there are really only two syndicates controlling the roads—the Grand Trunk and the Canadian Pacific Railway Companies. In 1852 not a mile of railroad was in operation in the country, and the first built was the Northern, which now stretches past the Muskoka District and strikes the line of the Canadian Pacific at North Bay, near Lake Nipissing. After the Northern, came the Great Western, the main line of which connected Niagara Falls and Detroit, and formed a through route in connection with the American railroads between New York and the far West. The Grand Trunk, built to connect the interior of Canada with the seaboard followed, and as time went on these roads added numbers of branches to their systems, tapping the outlying districts of the Province in every direction. An amalgamation of the Great Western with the Grand Trunk was effected a few years ago; and still more recently the Grand Trunk has absorbed the Northern system. The great trans-continental line of the Canadian Pacific Railway was opened for passenger travel from ocean to ocean on 28th June, 1886—the terminus on the Pacific being Port Moody, distant from Montreal 2,801 miles, and from Quebec 3,650 miles. It is now possible to reach almost any place of any importance in Canada by rail, and every year additions are being made to our railway system. The most recently constructed line is the extension of the Canada Pacific Railway from Woodstock to London. The Grand Trunk has lately been paying dividend to its stockholders and the outcome of this is, that the entire line is to be double tracked. This work will be accomplished in sections, those portions of the road where the traffic is the heaviest being the first to be relieved. Quite lately tenders were called for by the company and operations are now in progress. It is confidently believed by many persons that in the near future the Grand Trunk and Canadian Pacific Railways will amalgamate, and that eventually the Government will assume control of the whole railroad system of the country. This opinion, however, there is nothing at present to justify, as to all appearances the two great corporations are full of life and keen rivalry. There are in operation in Ontario over 5,000 miles of railroads, and construction has been greatly aided by grants given on certain conditions by the Provincial Government.

It having been a subject of complaint that the railways discriminated in rates by charging sometimes no more for a long haul than for a short, and by giving special quotations to large shippers, the Dominion Government recently appointed a Railway Commission to take evidence all through the country and enquire if any and what abuses existed, with a view of ascertaining whether or not the appointment of a permanent Railway Commission would be advisable. At present railway matters are dealt with by a committee of the Privy Council of Canada, and its methods are somewhat slow, expensive and cumbersome. The Commission duly met, Sir Alex. Galt in the chair, and took considerable evidence at important railway centres, but the commission has not yet borne fruit in the form of practical legislation. A good deal of dissatisfaction apparently exists among stock-breeders at the want of facilities for transporting valuable animals to fairs and other places by rail, and at the high rates charged. These exists among stock-breeders at the want of facilities

for transporting valuable animals to fairs & 1 other places by rail, and at the high rates charged. These and other matters laid before the Commission will in due time receive the attention of the Government.

The ordinary driving roads of Ontario are kept in good condition by the various Counties through which they pass, while the colonization roads through new districts are looked after by the Government.

PUBLIC SCHOOL SYSTEM.

The Public School system of Ontario is considered to be one of the best in the world. The father of the system was the late Rev. Dr. Ryerson, a Methodist minister who had a genius for educational matters. The Public Schools are under the immediate control of the Provincial Minister of Education, that post at present being filled by Hon. G. W. Ross. Education is free and also compulsory, but Roman Catholics are not bound to attend Public Schools, but are entitled to establish, wherever they are numerous, what are known as Separate Schools for themselves. There are altogether nearly 5,000 Public Schools in Ontario, and 200 Separate Schools, and upon these is expended annually the sum of \$3,000,000. The Schools are supported by a special tax which is augmented by a grant from the Legislature. Each township is divided into so many sections, with three trustees for each. This board has the employing of the teacher and superintends the affairs of the school. There are also 53 inspectors of schools for the Province, the number of schools under charge of each not exceeding 120 nor being less than 50. The inspectors are paid partly by the township council and partly by the Government. The visits of the inspectors take place every six months, and reports are sent on each occasion to the Minister of Education. The Separate Schools receive a separate grant from the Government, and Roman Catholics are not bound to contribute to the support of the Public Schools. Besides the Public Schools, there are also High Schools, which are usually located only in Cities, Towns or Villages. At Toronto and Ottawa, Normal Schools for the training of teachers are in operation, and are doing admirable work. Altogether there are about twenty Universities and Colleges in the Province, three of them being Roman Catholic, and over 100 High Schools and Collegiate Institutes. There are in operation a grand total of between 5,500 and 6,000 schools in Ontario, counting private institutions. The principal University in the Province is the University of Toronto, and a disposition on the part of smaller institutions to affiliate therewith is becoming more marked every day. At the General Conference of the Methodist Church of Canada held in Toronto last year, it was decided to remove Victoria University, the property of that body, from Cobourg to Toronto, thereafter to become part and parcel of the University of Toronto, although occupying a separate building in the Queen's Park. The only objection urged against this step was, that Victoria University would lose its degree-conferring power, but as the proposed change was evidently in the interest of higher education, the motion was carried and Rev. Dr. Potts was appointed General Secretary to raise the sum of \$450,000 with which to build the college and provide endowments for the chairs.

PROVINCIAL GOVERNMENT.

Ontario has a Lieutenant Governor, who is supposed to act for the Governor General, the representative of Her Majesty. The Lieutenant Governor is however, entirely under the direction of his Ministry, who may belong to either political party. There is also an Executive Council of five members, consisting of the Ministers for the various departments, who are really the rulers of the Province. The Legislative Assembly consists of about ninety members, who are elected by the people.

LEGAL SYSTEM.

The laws of Ontario are almost the same as those of England, and the courts are also very nearly the same. When, therefore, the courts of law an equity were fused

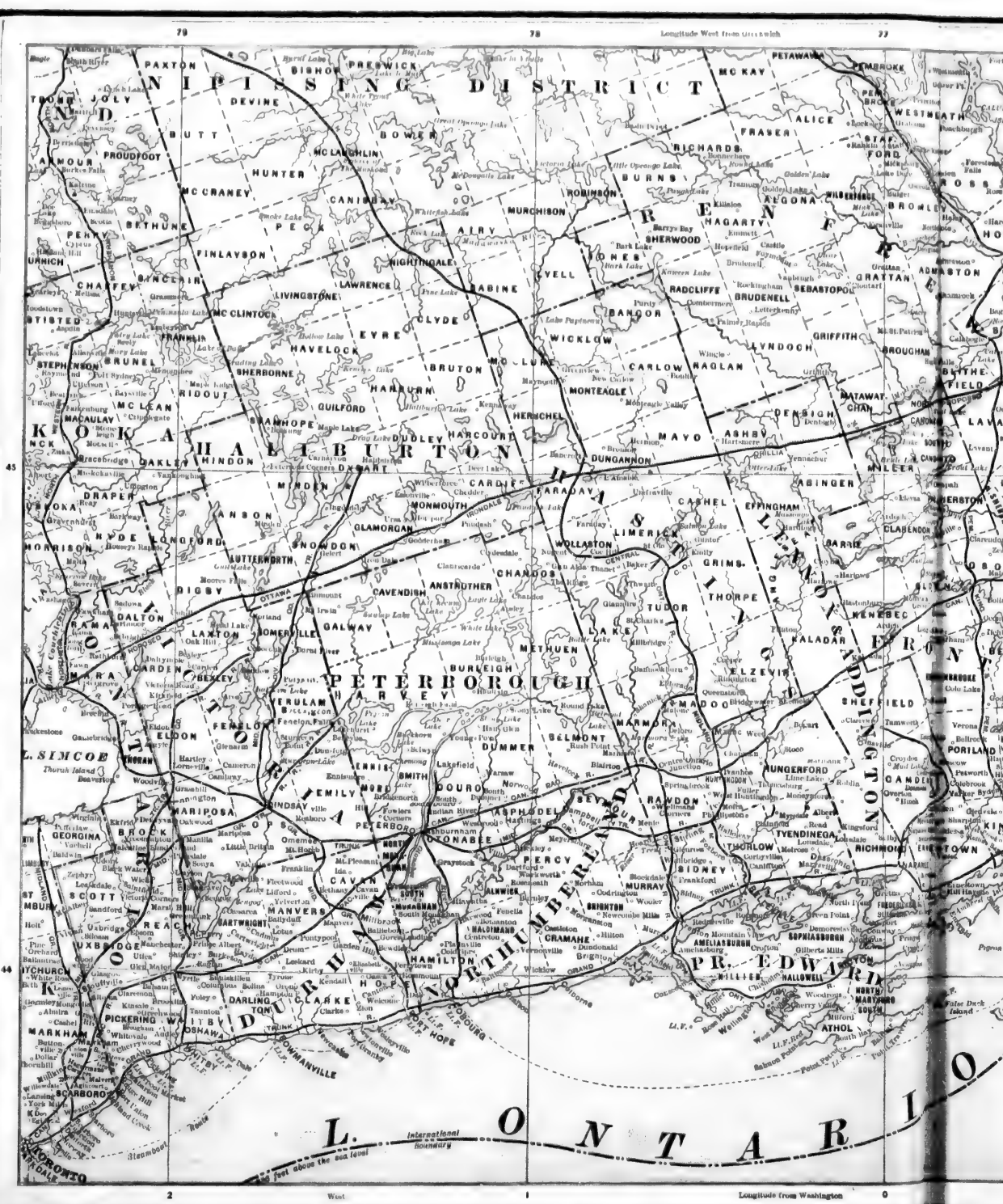
in England, the subject was mooted here, and very soon a similar act was passed resolving the courts of Queen's Bench, Common Pleas, and Chancery into "The Supreme Court of Judicature for Ontario," and leaving the Court of Appeal in its former position. The old courts are now known as Divisions, each Division being presided over by three judges. In the Queen's Bench and Common Pleas there is a Chief Justice and two Justices and in the Chancery Division a Chancellor and two Justices. The Court of Appeal is presided over by a Chief Justice, and associated with him are three Justices. These judges are all appointed by the Dominion Government and go on a circuit through the country to try civil and criminal cases at the various towns at the regular Assizes. The courts also sit en banc at Osgoode Hall to hear all matters of law which may come before single judges or the full court without juries. Besides the Superior Court and Court of Appeals there are Division Courts in every County, presided over by the County Judge, at which suits for small amounts can be tried by the Judge alone or by a jury of five. The jurisdiction of these Division Courts has lately been greatly enlarged, and the amount of claims decided in them every year is very great. Division Court sittings are usually held every month in large cities, and every three months in small places. The County Judges and Police Magistrates have also jurisdiction in certain criminal matters, which are disposed of by them from time to time.

FREE GRANT LANDS.

The Free Grant lands of Ontario, situated in the Muskoka District, are capable of being converted into first class farms, and can be had for the asking. Over 3,000,000 of acres were originally thrown open to settlers by the Government, but of course large tracts have been taken up. Every person with a family can secure 200 acres of these lands gratis and any one who has arrived at the age of 18 years is entitled to 100 acres. The conditions upon which a grant can be secured are: fifteen acres to be cleared and under crop, two acres at least of which are to be cleared and cultivated annually for five years; a habitable house 16x20 feet must be built, and the settler must reside on the land at least six months in each year. Of course land can be purchased either from private individuals or companies in any part of the Province. It should be mentioned that the free grant lands around Haliburton and Minden are just now attracting a good deal of attention and the display of roots, fruits and cereals shown from this district at a recent Industrial Exhibition in Toronto was really magnificent.

THE CITY OF TORONTO.

It is estimated that the City of Toronto, the capital of the Province of Ontario, has a population of about 140,000. It has grown amazingly, and it is continuing from day to day its marvelous progress. In 1884 was celebrated the semi-centennial year of the City, and during the ten years immediately preceding that event the population of Toronto doubled itself. The city is situated on Toronto Bay, which is formed by a long narrow island stretching in a crescent shape along the shore of Lake Ontario and extending from the River Don almost to the Humber. This island is used as a summer resort, a great many citizens having built residences there. Hurlan's Point is the extreme westward section of the island, and on it stands an hotel erected by Edward Hurlan, the great sportsman, who for some years was champion sculler of the world. The city is irregularly built, but possesses many very handsome and substantial buildings. Everywhere can be seen reminiscences of by-gone days in the shape of old stores and dwellings that look much out of place beside modern structures. But these are gradually passing away, and in a few more years they will have disappeared altogether. The principal business streets of Toronto are King, Queen and Yonge, which are occupied almost entirely by retail storekeepers the wholesale houses finding



79

78

Longitude West from Greenwich

77

45

44

2

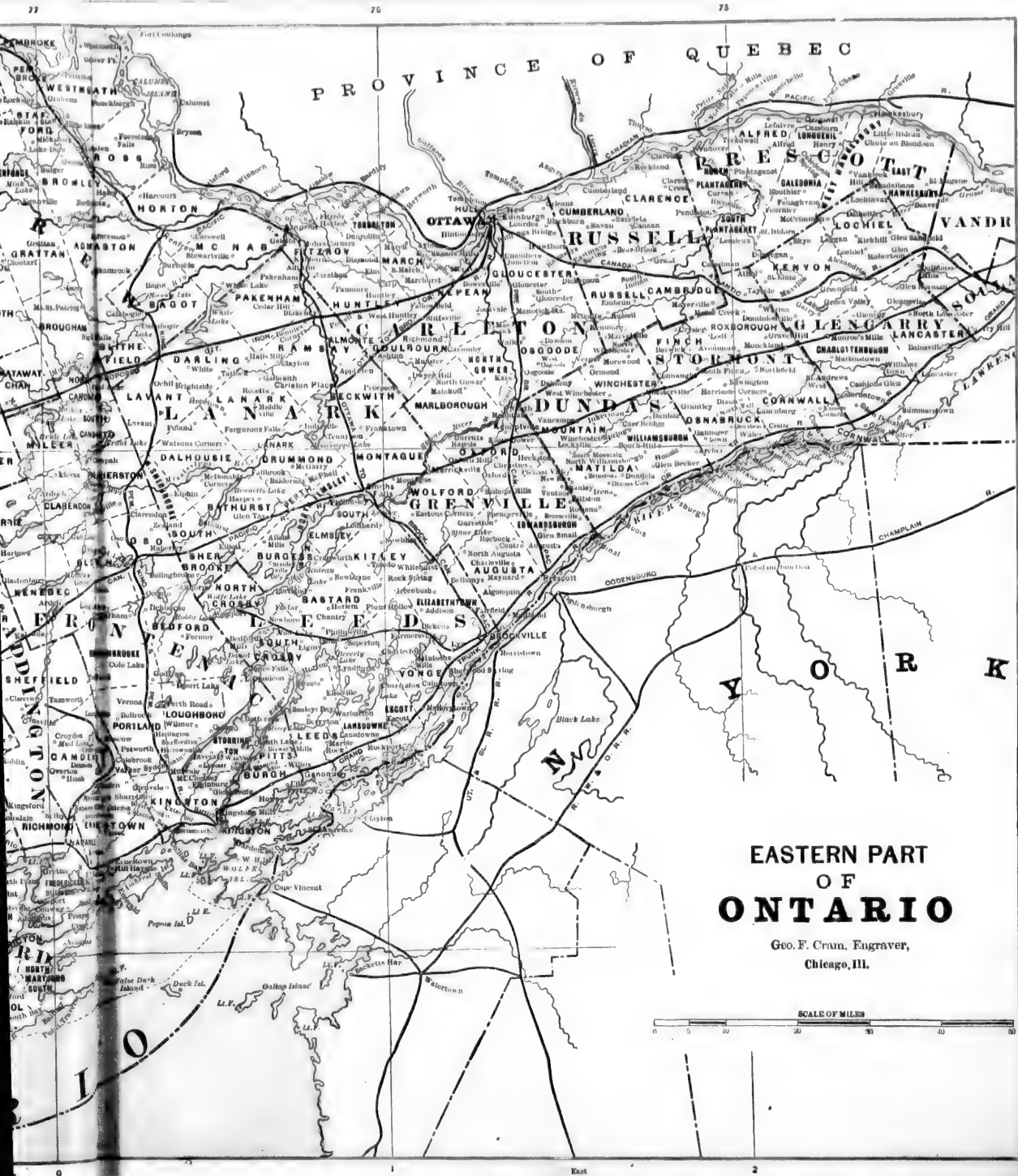
West

20

1

Longitude from Washington

0



EASTERN PART
OF
ONTARIO

Geo. F. Crum, Engraver,
Chicago, Ill.



There are on Wellington and Front Streets some magnificent wholesale warehouses. There are some noble bank buildings in Toronto, that recently erected by the Bank of Montreal on the corner of Yonge and Front Streets being the finest. It cost \$100,000, but although constructed of the best description of stone and elegantly finished, it is so situated that it looks insignificant among higher but far less handsome structures. The Canadian Bank of Commerce are now putting up a building on the corner of King and Jarvis Streets which promises to be a splendid structure. The Dominion Bank, corner Yonge and King Streets is also a fine building. The Canadian Life Insurance Company has undertaken the erection of a large and beautiful building on King Street almost opposite the Bank of Commerce. Some of the Educational and Public Buildings of Toronto deserve mention. Toronto University, which stands in the Queen's Park, is one of the few buildings which, owing to its beautiful proportions and massive build, can never look other than imposing. It will practically never grow obsolete and will always be seen to advantage, standing amidst its handsome grounds. Within a stone's throw of the University the walls of the new Parliament buildings, which are to cost \$1,000,000, are now being built. The site for the buildings is a magnificent one, situated in Queen's Park at the top of a gradual slope of nearly half a mile. The present Parliament buildings, consisting of a collection of red brick structures which are more of an eyesore than anything else, were put up many years ago, and now can only be looked upon as a nuisance. Osgoode Hall, named after the first Chief Justice of Upper Canada, is a large pile of buildings on Queen Street at the head of York. It has been built at different times, and contains very handsome court-rooms, corridors, halls and offices. The Normal School, where public school teachers are instructed, stands in the midst of a well laid out square bounded by Gould, Church, Gerard and Victoria Streets. The Toronto General Hospital stands on Gerard Street east, and is surrounded by beautiful grounds. Wings have been added to it several times, making it a large and commodious building. The Post Office stands on Adelaide Street, at the head of Toronto Street, and is a fine structure. Unfortunately it is fast becoming altogether too small for the requirements of the city. The College of Physicians and Surgeons for Ontario are erecting a remarkably handsome structure of stone and red brick on the corner of Bay and Richmond Streets. The Orange Hall on Queen Street, between Church and Victoria, is a large red brick building of imposing appearance. The new hall for the Y. M. C. A. on Yonge Street, which is rapidly approaching completion, is very large and presents a splendid appearance. The Central Prison, the Mercer Reformatory, the Masses' Manufacturing Company's works (for agricultural implements), the Abell Engine works, the Insane Asylum, and other buildings both public and private, lie on the western outskirts of the city. The Mail building, on the corner of King and Bay Streets, is a very fine piece of architecture, reminding one of the great newspaper offices of New York.

The churches of Toronto are very numerous, and some of them are remarkably handsome. The finest architecturally is St. Andrews (Presbyterian), on King Street, after which may be mentioned St. James' Cathedral (Anglican), the Metropolitan (Methodist), Jarvis

Mention must also be made of the new Cathedral, St. Albans, (Anglican), now in course of construction, and which promises to be one of the handsomest structures in the city.

The buildings devoted to amusements consist of the Grand and Toronto Opera Houses, and the Horticultural Gardens Pavilion, the latter being used principally for concerts and musical events. The theatres are usually well attended and the best attractions on the road are to be seen there. The Pavilion stands at one end of several acres of very well laid out gardens, and is constructed principally of glass. The gardens are open to the public during the summer, when military bands frequently play there. The largest open space in Toronto is the Queen's Park, which has been greatly curtailed in size in recent years by buildings. The new Parliament buildings and Victoria college will further decrease its area. The Grand Trunk, C. P. R. and Northern and Northwestern Railways all centre at Toronto, and the Union Station on the Esplanade is far too small for the traffic of all the roads. The project is being mooted, however, of erecting a structure worthy of these great corporations but as yet, nothing definite has been done. The steamer travel from the Port of Toronto is very large, and is on the increase every year. The steamers of the Richelieu Navigation Co., run down the St. Lawrence to Montreal, as do also the Merchants line of propellers. These latter proceed up the lakes to Buffalo, Detroit, Chicago, etc. The Chicago runs across Lake Ontario to Niagara, the Empress of India to Port Huron, the Rupert to Grimsby, the Northern Belle to Hamilton, and a fleet of others steamers and ferries to the island of Victoria and Lone Parks, Longbranch and other resorts along the lake shore within about a dozen miles of the city.

Toronto is not only the capital of the Province in name, but also in reality. It is much the largest City in Ontario, and is a great centre of learning, manufacturing, and business of all sorts. Some of the colleges situated in Toronto (besides the University), are Mc Master Hall, Baptist Theological College Trinity College (Anglican), Wycliffe College (Evangelical), Knox College (Presbyterian), College of Pharmacy, Trinity Medical School, Toronto School of Medicine, Toronto Conservatory of Music, Upper Canada College, Toronto Veterinary College, the school of Technology and many other institutions both of a public and private character.

The charitable institutions of Toronto are very numerous, and among them may be mentioned the Boys' and Girls' Homes, The Newsboys' Lodgings, the House of Providence, the Hospital for Sick Children, the House of Industry, (founded in 1837), the Home for Incurables, the Convalescent Home, the Home under the management of the Anglican Sisterhood of St. John the Divine, the Good Shepherd's Home, etc.

The principal hotels in Toronto are the Rossin, the Queens, the Walker and the Palmer, of which the Rossin is the largest. The Albion on St. Lawrence Market Square is a great resort for farmers and cattle dealers.

The manufacturing interests of Toronto cover every branch of trade, including iron foundries, agricultural implement works, railway car shops, engine works, carriage factories, tanneries, soap works, tobacco and cigar manufactories, machine shops, pork-packing establishments, boot and shoe factories, sewing machine manufactories, a silver plate ware factory, stove foundries, breweries, and the largest distillery in the Dominion.

The business streets of Toronto have cedar block roadways and either wooden or stone sidewalks. The cedar blocking is, however, not durable enough, and must eventually give place to stone. Stone sidewalks

are being constantly laid down, the material coming from Pelé Island, on Lake Erie, where there are numerous quarries. The residential portion of the city is beautifully planted with horse-chestnut, maple and other varieties of trees, and the private houses are many of them exceedingly tasteful and commodious. Water is supplied to the City of Toronto from Lake Ontario, which is pronounced by analysts to be of exceptional purity. The bay at present is polluted with sewage, which cannot be long allowed to continue. The city has a remarkably efficient fire brigade, stations being placed in every direction throughout the municipality. The police force of Toronto the citizens especially pride themselves upon. Every recruit must be at least 5 feet 10 inches in height, and most of the men are taller.

The militia regiments of Toronto are the most efficient in the Province. The Queen's Own Rifles, now under command of Lieut-Col. Allan, is the oldest, and is composed principally of clerks, students, young professional men and those engaged in sedentary employments. Its *esprit de corps* and high discipline are well-known all over Canada, and when in the field the regiment has endured the hardest work with the stoicism of veteran troops. Part of the Queen's Own took part in the battle of Cut Knife in the Northwest Territories, and in a most trying expedition sent to capture the Indian chief Big Bear, which was ultimately successful. The Royal Grenadiers, commanded by Lieut-Col. Grassett, is another crack regiment, and was the backbone of Gen. Middleton's column, which captured Hatoche, and put an end to the Northwest rebellion. The Governor-General's Body Guard, consisting of two troops of cavalry, under Lieut-Col. Geo. T. Denison, also did excellent service in suppressing the insurrection. The Toronto Field Battery is an efficient corps, and has prospered well under the direction of Lieut-Col. Gray. The Garrison Artillery is also a fine body of men, and is thoroughly up to the mark in matters of discipline. The fort which lies to the west of Toronto, is under charge of "C" Permanent Corps, commanded by Lieut-Col. Otter. The want of a new drill shed has long been felt by the volunteers of Toronto, and it is probable that very shortly one will be built. The Dominion Government at the last session of Parliament, made an appropriation of \$30,000 for the purpose, which amount will be augmented no doubt by future grants. The city gives a free site, the location probably being in St. John's ward, behind Osogode Hall, and not far from where the new combined court house and city hall is about to be erected.

There are several monuments erected to the memory of Toronto volunteers who fell in defense of their country. One is in the Queen's Park, and was erected to the men of the Queen's Own who lost their lives during the Fenian Invasion of 1866. Another is at Mount Pleasant Cemetery, in commemoration of Lieutenant Fitch and Private Thos. Moor, of the Royal Grenadiers, who fell in the bayonet charge at Batoche.

Toronto is growing more rapidly than any other City of the Dominion, and the price of real estate has advanced of late years to an extraordinary extent. It is alleged by some that this advance amounts to a "boom," but however that may be, there is no doubt, that there was an under valuation in former years. Property on leading thoroughfares it is safe to say, will never go down, although in the suburbs, depreciation may take place. Building on a large scale has been in progress in Toronto some time, but the strikes among the various trades which occur every now and then, have a tendency to retard operations. It is almost needless to remark after what has been set forth already, that "the Queen City," as the capital of Ontario is frequently called, possesses all modern requirements, such as electric light, and telegraph and telephone systems, postal delivery, street cars, uniformed messenger boys, coupe lines, and all the other essentials to nineteenth century life in a great centre.

DOMINION OF CANADA.

OTTAWA.

The City of Ottawa, situated on the river of that name, was formerly known as "Bytown," and was made the seat of Government in 1855. Niagara, Kingston, Toronto, Quebec and Montreal had each in their turn been honoured in this way, and it was at the suggestion of the Queen herself, that the vexed question of where to finally locate the capital of Canada was decided. The town of Hull on the north side of the river opposite "Bytown," was first settled in the year 1800 by Philemon Wright, a farmer of Woburn, Mass. One of Wright's employees named Nicholas Sparks, on speculation purchased a quantity of land on the south side of the river, then deemed of no value, but which was afterwards sold by him to the Government and to settlers at a profit to the owner of about \$200,000. This sale took place in 1813-15, when the Imperial Government decided to construct a series of canals connecting the Ottawa and the Upper Lakes by way of the Rideau. "Bytown" had a population of 18,000 in 1860, and was made the capital of Canada. Since then the city has grown and prospered until it has now a population of about 55,000. Ottawa is a great centre for the lumber trade, which is carried on very extensively through all that section of country, and on the broad bosom of the river floats many a raft of logs on its way towards the great ship building yards. The principal features of interest about Ottawa are the Parliament and Departmental Buildings, which are magnificent structures. These were first commenced in 1859, and the Prince of Wales laid the foundation stone in 1860. They were occupied in 1865 although still in an incomplete condition. The library and other portions have since been added, and the entire cost of the structures as they stand to-day was about \$5,000,000, the area they occupy being about four acres.

Government House, the residence of the Governor General, is situated about two miles from the City. The name of the building is "Rideau Hall." It is a comfortable place with no pretense at appearance, and is destined before long to give way to a vice regal residence of more modern style.

Ottawa contains a number of churches, manufactories, banks, mills, educational and charitable institutions, and is the home of a small army of civil service employees. During the session, it is crowded not only with members of Parliament and those who are there strictly on business, but with numbers of persons who are well versed in a species of "log-rolling," of the very rudiments of which the lumbermen of the Ottawa are ignorant.

HAMILTON

The City of Hamilton is situated on Burlington Bay at the western end of Lake Ontario. It has a population of about 45,000, and is a commercial and manufacturing centre of no small importance. It is very accessible both by land and water, and is situated on what used to be the main line of the old Great Western Railway (but which now belongs to the Grand Trunk), and runs from the Suspension Bridge to Windsor, opposite Detroit. The chief offices and workshops of this division of the Grand Trunk are situated here, employing many hundreds of men all the year round. Hamilton is also the southern terminus of the Northern and Northwestern Railway, which runs from there to Barrie and other points. It has been arranged that in the near future the Canadian Pacific Railway will find its way to Hamilton. At the back of the City of Hamilton rises a lofty plateau of ground known as "The Mountain," which is thickly wooded, and adds much to the picturesque appearance of the landscape.

The wholesale houses of Hamilton are amongst the best in the Dominion, and do an immense trade. Many of the early settlers of this locality were Scotch, and

their thrifty habits and business capabilities have done a great deal towards helping Hamilton forward.

The City also possesses many important manufactories, and is the headquarters of the Bank of Hamilton, as well as having branches of nearly all the other banks of the Province. The water works system of Hamilton is a very fine one, the supply being taken from Lake Ontario nine miles from the reservoir. The City also has excellent drainage facilities, street cars, gas and all modern requirements.

Dundas, which is almost a suburb of Hamilton, is situated five miles to the westward, and the two places are connected by the G. T. R., by the Desjardins Canal, once the scene of a frightful railroad disaster, and by a tramway. In Dundas several important industries are located, including the Mottram Machine and Tool Works and cotton and woollen factories.

KINGSTON.

Kingston is situated at the eastern end of Lake Ontario, as Hamilton is at the western, and at the commencement of the Thousand Islands, so famous for their beautiful scenery. Kingston was at one time the capital of Upper Canada, but it is now known as the seat of the Royal Military College and a port of great strength. Near Kingston is the Village of Portsmouth, where the Penitentiary for the Dominion and a large Insane Asylum are situated. The military works at Kingston are very extensive, and there is always a garrison there including "A" battery of artillery, a permanent corps. The chief fortifications commanding the harbour are on Messessaga, and Navy points; and a fortress is placed on Point Henry. Lines of steamers running from all points on the upper lakes call at Kingston, and steamers also ply between there and the American shore. The manufactures of Kingston include ship building, locomotive works, car shops, agricultural implements, stove foundries, piano and melodeon factories, tanneries, breweries, etc. It has also an important grain shipping trade. The public buildings of Kingston are numerous, handsome and substantial, and include Queen's and Regiopolis Colleges. The City is connected with Pembroke, 130 miles away, by rail, and with the Ottawa river by the Rideau Canal. The population of Kingston is about 20,000.

LONDON.

The City of London, in the County of Middlesex, lies in the midst of a section of country rich in agricultural resources. It is often called "The Forest City," not only because its site was once an unbroken forest, but because even now, the horizon as seen from any of London's lofty buildings, shows wooded country on every side. In 1826 the first trees were cut at "the forks of the Thames," the present junction of Dundas and Rideau streets, two of London's principal thoroughfares. The following year a log gall and a courthouse were erected, and the settlement began to grow rapidly. In 1835, the assessment was \$35,000, and the population 1,000. From this small beginning has sprung a City of over 50,000 inhabitants with assessable property amounting to \$12,000,000.

Besides being a great centre for the disposal of their products by the farming community, London is a very important manufacturing and commercial City. Its wholesale houses are all known throughout the west and do a flourishing trade, and all its business establishments are thoroughly up to the times. Carlings and Labatt's breweries, the McClary Stove Manufacturing Co., E. Leonard & Son's Engine Works, the Bennett Furnishing Co., the Ontario Car and Foundry Co., the Grand Trunk Car Shops, the London Furniture Manufacturing Co., and many other important industries are located at London and employ large numbers of hands.

The City of London is particularly fortunate in pos-

sessing a bountiful supply of pure water. It is obtained from inexhaustible springs that flow from the banks of the Thames a few miles to the westward of the City. The system cost \$500,000, and the quantity of water obtained is 3,000,000 gallons a day. Both hydraulic and steam pumping machinery is used.

London is the headquarters of the Bank of London in Canada, a flourishing monetary institution, and there are also located there a number of branches of other banks.

In educational matters, London takes a foremost position and possesses among other institutions, the Western University, with degree-conferring powers in arts, medicine and law; the Hellmuth Ladies' College, situated on the bank of the Thames, three miles from the City, the Academy of the Sacred Heart, (a Roman Catholic institution where young ladies are educated), Huron College, (an Anglican Theological institution), and many other schools and colleges.

As a railway centre, London is the most important point in Western Ontario. It is on the main line of the Southern division of the Grand Trunk, and the Canadian Pacific Railway this year completed their line from Woodstock to London. The Grand Trunk also connects with London by way of St. Mary's, and the Michigan Central have recently commenced running trains to the "Forest City" from St. Thomas.

London is the seat of public institutions, such as the Insane Asylum and the School for Infancy, and has a number of charities, which are conducted in a most efficient manner. The churches and public buildings of London, which include a very handsome opera house owned by the Masonic body, are a credit both to the City and to the Province.

ST. CATHERINES.

St. Catharines, one of the younger Cities of Ontario, is situated on the Welland Canal, between Hamilton and the Suspension Bridge, and especially during the war of the Rebellion in the States, was a great resort for American visitors. It possesses mineral waters of great curative powers, and invalids resort there a great deal. The Grand Trunk and Welland Railways touch St. Catharines, and Port Dalhousie on Lake Ontario, is only seven miles away. The City is a thriving business centre with many manufacturing interests, and a population of about 10,000. Very fine fruit grows in the neighbourhood, and the gardens of the City are beautifully laid out.

GUELPH.

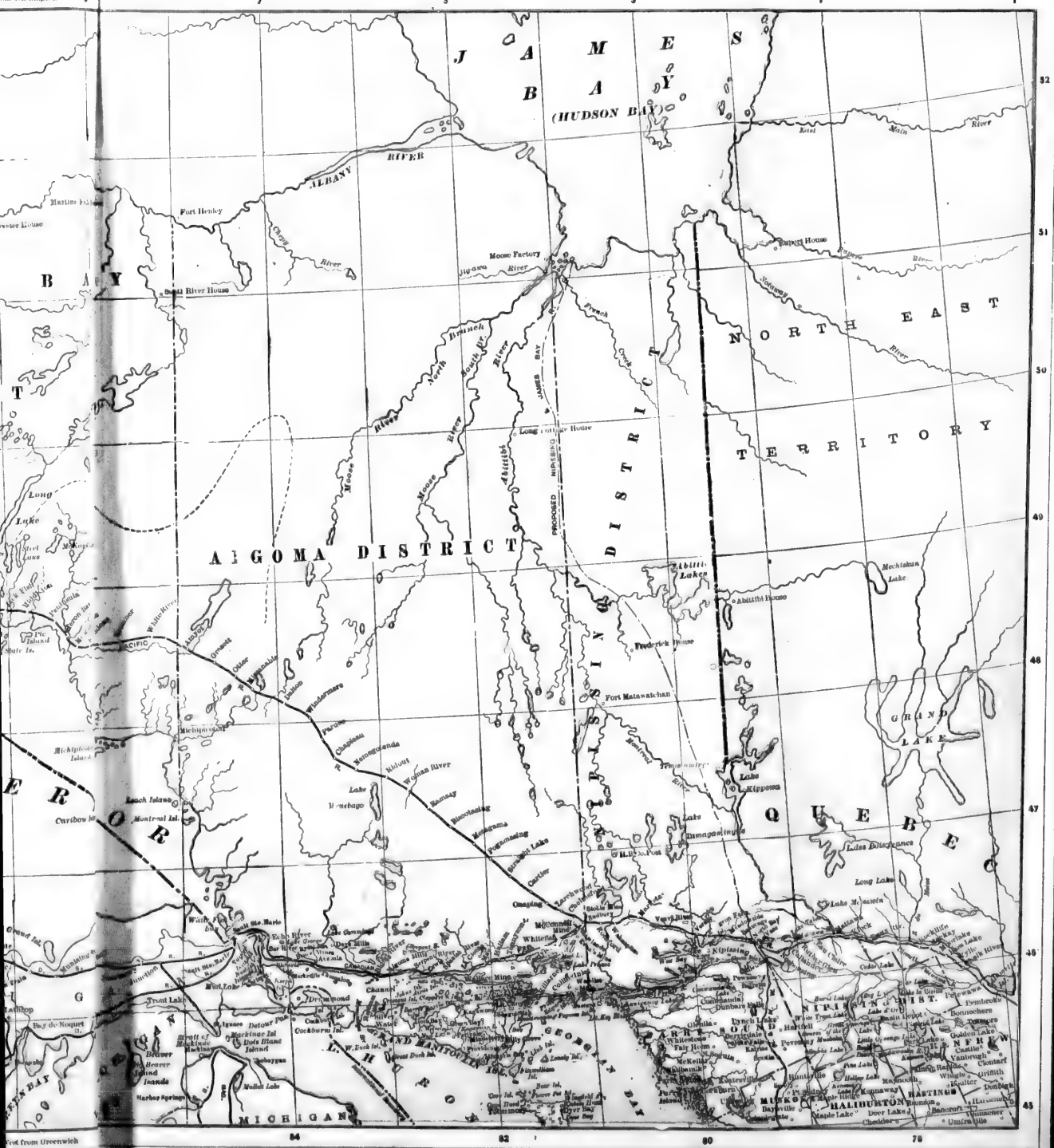
Guelph, situated on the River Speed, in the County of Wellington, is often called "The Royal City." It is very picturesquely located, and lies in the midst of a magnificent agricultural country. The County of Wellington is famous for its cattle raising, and many well known breeders of fine stock reside in Guelph. The Grand Trunk Railway connects with Guelph by way of the main line from Toronto to Windsor, and by way of the Wellington, Grey and Bruce Section of the Southern Division, formerly the Great Western. The City is built on hills, and the river Speed which runs through it, is a pretty stream. This river also serves the useful purpose of furnishing power for machinery, having falls about 50 feet in height, near which are located three or four flour mills, two saw mills, two planing mills, and woollen factories. Manufactories of iron castings, machinery and sewing machinery are also in operation, besides several breweries, and an important organ factory. Some valuable quarries are worked in the neighbourhood, and in the City are to be found all the various lines of business establishments necessary to an important centre. Guelph was incorporated in 1879 as a City with a population of 10,000, and its progress is and always has been of a substantial and satisfactory nature.



**NORTH-WESTERN PART
OF
ONTARIO**

Geo. F. Cram, Engraver,
Chicago, Ill.

SCALE OF MILES
0 10 20 30 40 50 60 70 80 90 100



DOMINION OF CANADA.

BRANTFORD.

The City of Brantford is beautifully located on the north bank of the Grand River. The ground on which the City now stands was originally occupied by the Six Nation Indians, and Brantford derives its name from Joseph Brant, the great Indian Chief to whom a monument was recently erected and unveiled with much ceremony. On the 19th of April, 1880, the Indians made a surrender to the Government of the town plot which was then surveyed by Lewis Burwell and sold by auction. On Monday, September 6, 1847, Brantford elected its first town councillors, seven wards being the number into which the municipality was divided. The first Mayor elected was Wm. Muirhead. In 1850 the town was redivided into five wards with three councillors for each. On March 2, 1877, Brantford having a population of 10,000 was incorporated as a City, the Council consisting of a Mayor and fifteen Aldermen. This event was appropriately celebrated and the young City was crowded with visitors from the surrounding country. Thus it was that Brantford grew from a settlement of twelve people in 1818 to a City of 10,000 in 1877. Brantford is situated on the Buffalo and Goderich branch of the Grand Trunk Railway, another branch of the same system running into the City from Harrisburg on the Southern Division. A third branch of the Grand Trunk connects Brantford with St. Thomas by way of Tilsonburg. The City is an important manufacturing place and possesses some very prominent industries. The Farm and Dairy Utensil Manufacturing Co. was organized in 1881 with a capital stock of \$50,000. This company employs about twenty men and does a thriving trade. A. Harris & Co. do an immense business in improved harvesting machinery. The establishment was founded in 1860 at Beausville by Alanson Harris, who in 1871 removed to Brantford. Immense new buildings were erected a few years ago and the firm are doing a business in their line unsurpassed in the Dominion. J. O. Wisner Son & Co. also do a very large business in the manufacture of agricultural implements. They employ several hundred hands. The Brantford Brewing Co. and Springbank Brewery produce fine qualities of malt liquor and do a large business. Workman & Watt, brick makers, Blacker Bros., Brantford Steam Brick Yard, City Broom Factory, Brant Canning Co., Brantford Carriage Works, City Carriage Works, Craven Cotton Mill, Cigar Box and Paper Manufactory, Paterson's Wholesale Confectionery and Cigar Manufactory, the Cockshutt Plow Co., the Waterloo Engine Works, and many other establishments too numerous to mention are located in Brantford. In the matter of banks Brantford is well provided for, having branches of several leading monetary institutions of Canada. The City also has several insurance companies. The public buildings of Brantford are very handsome and include a fine stone Court House, an Orphans' Home, a Custom House, etc. The buildings erected by the Grand Trunk Railway occupy eleven acres of ground, the principal being the repair shops, engine house and round house. The population of Brantford is now about 15,000, and it is considered one of the most flourishing cities in Canada.

BELLEVILLE.

The City of Belleville is situated on the Bay of Quinte at the mouth of the River Moira. It is a very important point on the Grand Trunk Railway system, being the place where the Eastern and Western Divisions of the road divide. The lumbering and milling interests of Belleville are its chief industries, but it also possesses considerable standing as a commercial centre. The population of the City is about 12,000, and it has every prospect of a prosperous career.

ST. THOMAS.

This young city takes its name from its founder, Colonel Thomas Talbot. It lies most picturesquely, situated 15 miles south of London, and 9 miles north of Port Stanley. Four railways converge to the city and make it an important business centre. The Michigan Central Railway has powerfully stimulated the growth of St. Thomas by the erection of extensive workshops.

STRATFORD.

The Grand Trunk workshops have had a similar effect upon the growth of Stratford, which reached civic honors in 1887. Occupying one of the finest sites in the vast tract which was planted out by the Canada Company, Stratford has steadily worked upon its geographical advantages, and must, from its mere situation, be always an important centre of trade. Notable among its public buildings are the Post-office, Court House and Jail, Collegiate Institute, and Central School. The river Avon furnishes power for manufactures, and by its lake-like expansion adds much to the landscape.

WOODSTOCK.

Woodstock, which now claims the rank of a city, is a remarkable illustration of what the pluck and enterprise of two or three sagacious residents will do to develop a town. When the Credit Valley Railway was still a paper scheme, laughed at in Parliamentary Committee Rooms, and generally much discredited, a few citizens of Woodstock took this "visionary" scheme in hand, shaped it into a business venture, and by sheer pluck and persistence made the new railroad a great highway of commerce. Other railways have since been brought to Woodstock, and with them have come several new industries, so that it would be difficult to set limits to the future achievements of this, the youngest of Ontario cities.

Besides those which have been mentioned there are in Ontario many prominent and promising towns which before long are destined to develop into cities. They are scattered over a wide area of country, and while some are local manufacturing and commercial centres, others thrive by reason of being located in rich agricultural districts. Prominent amongst these places may be mentioned, Barrie, Bowmanville, Brockville, Chatham, Cobourg, Collingwood, Cornwall, Galt, Goderich, Ingersoll, Lindsay, Napanee, Oshawa, Owen Sound, Paris, Peterboro', Petrolia, Port Hope, Sarnia, Stratford, St. Marys, Whitby and Windsor.

PROVINCE OF QUEBEC.

When Canada was ceded to Great Britain in 1763, the French Colonists were guaranteed the free exercise of the Roman Catholic religion and equal civil and commercial privileges as British subjects. They were also given further rights by the "Quebec Act" of 1774, whereby the old French laws, including the custom of Paris, the Royal edicts, and those of the Colonial Intendants under the French regime, were declared binding in relation to all property and civil rights; while the criminal law gave place to that of England with trial by jury. The French population of Lower Canada at this time did not exceed 65,000.

Quebec possesses the same power of self government as Ontario and has besides many old laws on its statute books operating in favour of the code originally brought over from France. In fact as regards all the Provinces of the Dominion the only rights claimed or exercised by the Imperial Parliament are, (1.) the right of appointing the Governor General; (2.) the right of disallowing acts not affecting trade and commerce within two years, and, (3.) the right of making treaties effecting the Dominion as a part of the Empire.

The Province of Quebec has an area of about 120,000,000 acres of land and extends along the valley of the St. Lawrence as far as the Ottawa river, which divides the Provinces of Quebec and Ontario. The Northern boundary of Quebec is as yet unfixed, while on the South, it is bounded by the Baie des Chaleurs, the Province of New Brunswick and the United States.

It is popularly supposed, particularly in the Upper Province, that Quebec is not a good Province for agriculture, but this is a mistake. Within the last 15 years the science of the husbandman has made great strides in portions of the Province, although other sections still remain what they were over a hundred years ago. Farming, it cannot be denied, is not up to the modern standard among the *habitants*. Sowing, tilling and reaping are performed by hand, and in the back country the methods of agriculture are very primitive. No mowing machines are used, threshing for the most part is done with flails, and all the various contrivances which are universally used by Ontario farmers, and without which, the outfit of an agriculturist would be looked upon as incomplete, have never been seen. The principal grain crops grown in Quebec are wheat, oats, maize, buckwheat, peas and beans. The beet-root is also being now raised extensively, several sugar refineries having been established for the purpose of better utilizing this vegetable. Hay, flax and hemp are also all good crops, and tobacco grows successfully in some sections. Fruit of all kinds grows luxuriantly, and the same may be said of vegetables. Taken altogether, the soil of Quebec can be cultivated with great profit, and it is only the isolation of the French farmer, taken in conjunction with the uncertain political condition of the Country, which prevailed up to 1840, that has held back agriculture.

Although as has been stated Quebec was originally populated by the French, there are a great many English speaking persons to be found in the Eastern Townships, and in the towns and cities, many of them being descendants of U. E. loyalists.

The climate of the Province in common with that of all Canada has been greatly misrepresented abroad. It is of course cold in winter, much more so than in Onta-

DOMINION OF CANADA.

rio, and there is a much heavier snowfall. But the weather is healthy, and the outdoor sports of Quebec, such as snowshoeing, tobogganing, etc., are celebrated all over the world. Fever, ague, and other kindred diseases are almost unknown and the climate on the whole is a very pleasant one.

MINERAL WEALTH.

In mineral wealth, Quebec is rich, and possesses valuable mines of gold, silver, copper, iron, lead, zinc and platinum. Much of this of course remains as yet undeveloped, but that these minerals exist in large quantities throughout the Province, has been established beyond a doubt. In the Eastern Townships, copper is found in considerable quantities, while the chief gold deposits are on the banks of the Chaudiere. Iron is found every where, and is of excellent quality.

LANDS.

There are in Quebec at the present time about 8,000,000 acres of Crown Lands, surveyed and ready for sale, and over 100,000,000 unsurveyed. These can be purchased from the government on the following conditions:—The purchaser is to take possession of the land sold within six months from the date of sale; is to reside on or occupy the same at least two years; is to clear and have under crop within four years, ten acres for every hundred held by him, and is to erect a habitable house of the dimensions of at least 16x20 feet.

On Provincial Colonization roads, some 84,000 acres are set apart for free grants, in lots of 100 acres each, and any person over 18 years of age may demand a permit of occupation from any Crown Land agent, and, if after he has occupied the land four years, he has cleared 12 acres and erected a house, he is entitled to a free patent. The valleys of the Saguenay, St. Maurice and the Ottawa; the Eastern Townships; the lower St. Lawrence, and Gaspé, are all open to Colonists.

In the valley of the Saguenay there are about 610,000 acres surveyed and divided into farm lots which can be purchased by settlers at 20 cents (10d. Stg.) per acre. The soil is rich and a road leads direct to the City of Quebec. In the valley of the St. Maurice 18,000 acres are for sale at 30 cents (1s. 2½d. Stg.) per acre. The valley of the Ottawa is very fertile, and land is being taken up there rapidly. The Province of Quebec abounds in rivers and small streams, which are well stocked with fish; something which cannot be said of the more populated districts of Ontario. In the Eastern Townships, the government owns over 400,000 acres of wild lands, which can be purchased for 40 to 60 cents (1s. 6d. to 2s. 5½d. Stg.) per acre. The climate is rather milder than at Quebec, and many settlers are coming in. On the South shore of the St. Lawrence, and below Quebec, are situated over 1,700,000 acres of Government land in farm lots, which is for sale at 30 cents per acre. The Tache road, 200 miles in length, runs through this important section. The district of Gaspé covers an area of about 8,618 miles of superficial territory, between the St. Lawrence and the Bay of Chaleurs, much of this is rocky and not fit for cultivation, but it contains some very fertile sections, and possesses magnificent fisheries.

The Province of Quebec is rich in lumber, and has vast forests of white and red pine. Ash, birch, beech, elm, hickory, black walnut, maple, cherry, butternut, fir and other sorts of wood also abound and are exported largely. The timber limits of Canada are of immense value, but until late years have not been regarded at their true worth. Since, however, so many railways have been constructed through the heart of unbroken forests, and far distant portions of the Province, brought into direct communication with all the markets of the Continent, and also with those of the old world, the people are beginning to appreciate the wealth which they possess in their lumber. It is to be regretted that in regard to "Timber Limits," there has been some scandals among the politicians, but even in this way, good may be accomplished by the attention

of the public being attracted to the proper use of what should be the common heritage of all. The system of granting licenses for the cutting of timber has been in force for a great number of years, but its various provisions have been altered from time to time. Between 30 and 40 years ago \$2 per square mile was looked upon as a high rate to pay for a timber limit, but in 1872 the privilege brought \$50 to \$95. The demand for lumber in the United States has increased so rapidly in recent years, that as long as the great timber forests of Canada last, a market can be found for them across the border, to say nothing of the immense quantities always required in England.

GOVERNMENT OF QUEBEC.

The Government of Quebec is vested in a Lieutenant-Governor, an Executive Council of seven members, a Legislative Council of 24 members, appointed for life, and the usual Provincial Legislative Assembly. The Courts consist of a Court of Queens Bench, with a Chief Justice and four assistants; a Superior Court with a Chief Justice and 20 assistants; a Court of Vice-Admiralty; Courts of Quarter Sessions; and Courts for small suits. The administration of Justice both as regards the civil and criminal law differs in many respects from the procedure in Ontario. This arises in a great measure on account of the existence of the old French code previously alluded to.

EDUCATION.

The Provincial Secretary has charge of educational matters, and bears the additional title of Minister of Public Instruction. He is assisted by a council of 21 members, appointed by the Lieutenant-Governor, of whom 14 are Roman Catholic and 7 Protestant. The Roman Catholics of the Province of Quebec being largely in the majority, the Public Schools are under the auspices of that Church, and the Separate Schools are directed by the Protestant minority. No person therefore is bound to support the Schools of those who differ from him religiously, but a moderate tax is levied on all for the benefit of primary education. In those municipalities where there are different religious sects, the School Commissioners of the majority rule. But in the Cities of Montreal and Quebec there are separate Boards of Commissioners for Roman Catholics and Protestants. The teachers are instructed in Normal Schools which are supported by the Province. There are in the Province some 4,000 elementary schools, 250 model, and over 150 Agricultural, Commercial and special Schools, in addition to 20 Classical Colleges and Seminaries. McGill College at Montreal, founded in 1827, and Bishop's College at Lennoxville, founded in 1843, are Protestant institutions, while the Roman Catholic University of Laval, at Quebec, was founded in 1852. There are probably over 1,000,000 inhabitants of the Province of Quebec, who profess the Roman Catholic faith.

Before the completion of the C. P. R., there were about 1,750 miles of railway in operation in Quebec.

The feudal system has always had a deeper hold on the Province of Quebec than it ever possessed in Ontario, and, although feudal tenure was done away with by an act of 1854, it has left many traces. The original seigniories into which the land was divided, and, which generally corresponded in size with the parishes, are now territorial divisions, and have been placed under the modern municipal system. Some are still held by the descendants of the grantees, others are in the hands of strangers, and still others are in the possession of religious corporations. The Seminary of St. Sulpice at Montreal, is the principal ecclesiastical holder of lands in the Province, and owns the Island of Montreal, St. Sulpice and the Lake of Two Mountains. The Seminary of Quebec, also holds the Cote de Beaupre.

One of the peculiarities of the *habitant* is the fact that although he is saving and thrifty enough, he is so afraid of losing his capital that he will not speculate with it, however good the security offered. He therefore either places his money in a savings bank, or hoards it up in some secure place about his house.

The entire Colonization system of Lower Canada may be said to have depended upon the *Seigneur* and the *Cure*, and "The Sword, the Cross and the Plough," were, it is said, the watchwords of Canadian nationality.

All through the agricultural districts of Quebec the French-Canadian women work in the fields beside their fathers and brothers, and hire out like men during harvest time. The peculiar vehicles to be met with on the roads of Quebec are not found in any other part of Canada. In many districts dogs are used to draw loads to market, while *caches* or two wheeled vehicles capable of accommodating two passengers besides the driver, and the charette or market cart, another two wheeled concern, drawn by the stout ponies of the country, are seen everywhere.

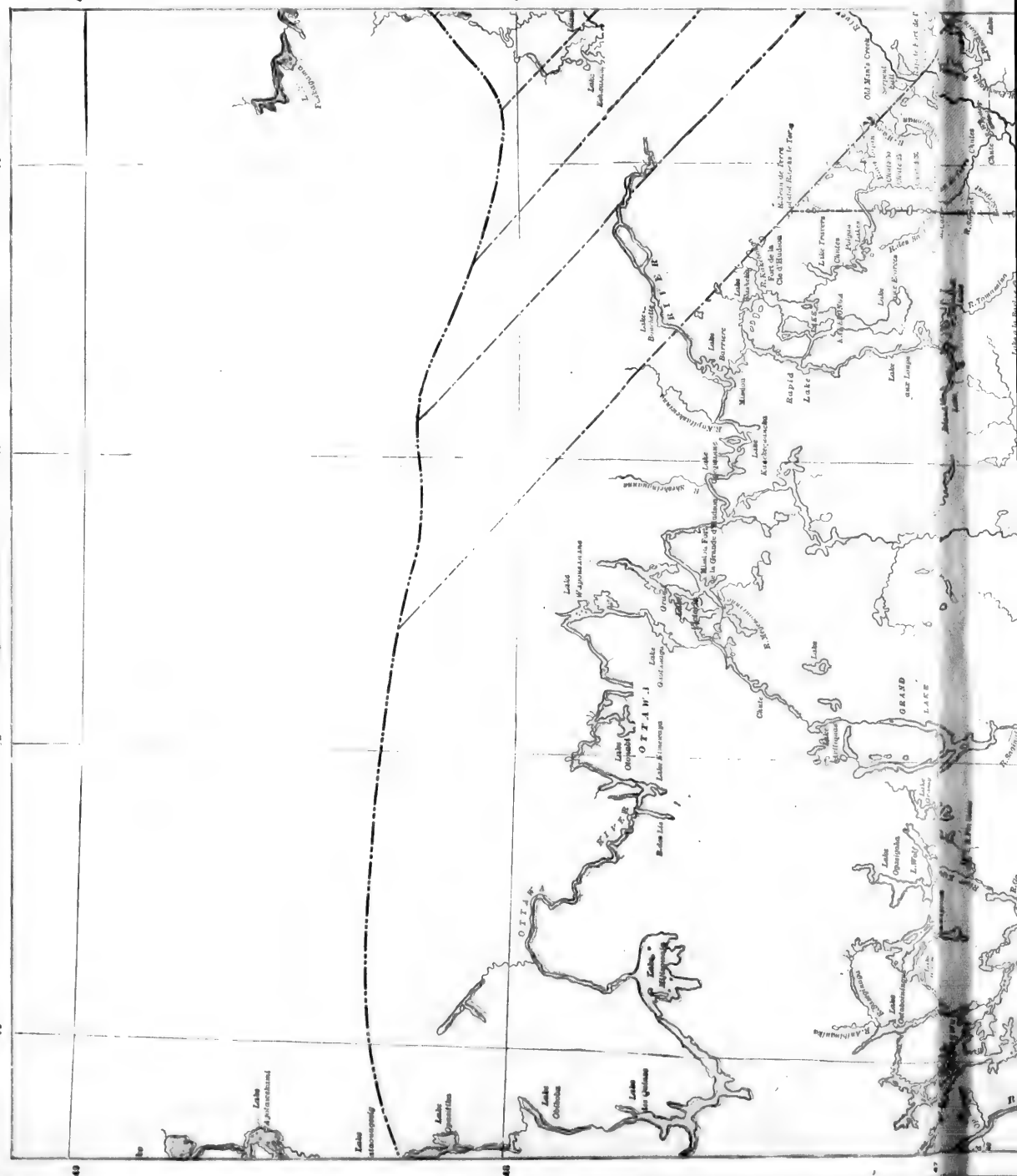
The houses of the *habitants* are as a rule, long, low one-storey cottages, rudely built of wood or rough stone. These places of abode are very picturesque and in some respects comfortable. As the owners are fond of flowers, the garden plots and windows usually present in summer a very gay appearance.

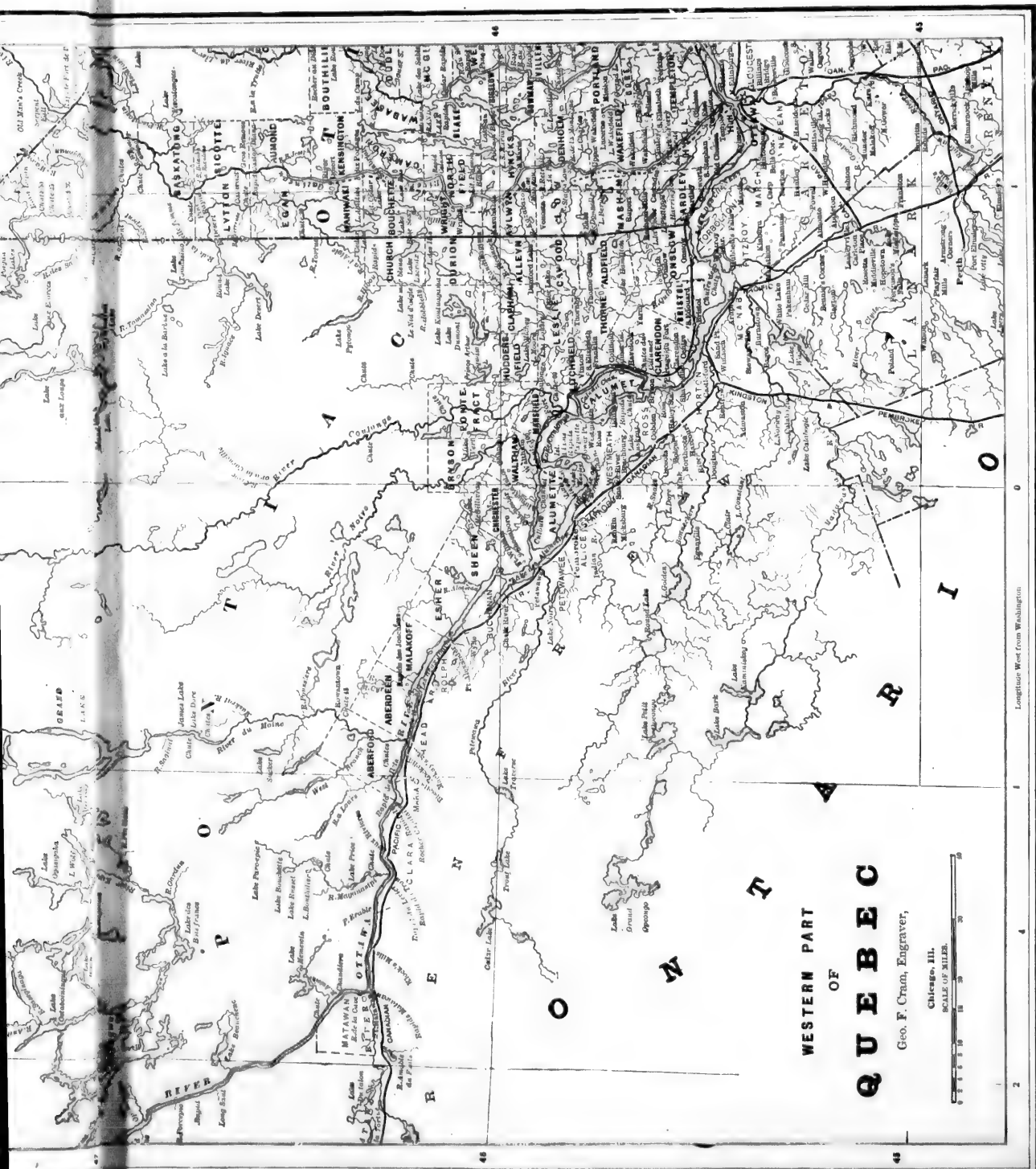
Under the land survey of France, which is still preserved in Lower Canada, the farms were apportioned in long narrow strips, so as to give to each person a diversity of land and a supply of water, in case the property bordered on a river. When the owner died the land descended to his children, and the farm was sub-divided amongst them on the same principle. The consequence of this system is that many French farms are perhaps less than a hundred yards wide by a mile or two in depth. These narrow farms or *terres* as they are called, were originally three arpents wide by thirty deep, (the arpent being equal to 191 English ft.) i.e. by a little over a mile in depth. This system can be observed all along the river St. Lawrence, where the old French farms lie in a belt from two to ten miles wide. Back of these are a second line of Scotch and Irish settlements, and further back still, are the halldations of scattered backwoods men. The old French system was well suited to the requirements of the Colony. In early days when raids from the dreaded Iroquois were continually apprehended. It had the effect of bringing the houses of the settlers close together, which greatly enhanced their chances of defence. But it is a system which could never commend itself to the English speaking race, who are not inclined on this Continent, at least, for the mere sake of sentiment, or from a dislike to change, to cling to old traditions, unless they seem to be intrinsically worthy of continuance. The fact that the Government of the Dominion would not survey the farms of the French half breeds who had squatted on the banks of the Saskatchewan, after this antiquated, and one might almost say, grotesque fashion, was one of the causes which led to the outbreak of 1885 in the Northwest, which cost so much Canadian blood and treasure.

MONTREAL.

The City of Montreal is the most populous city in the Dominion of Canada, having, in 1887, according to the municipal census, a population of 186,000. Montreal has always been the commercial capital of Canada, and at one time commercial travellers from that city made tours all through Ontario. But although that period has passed away, and Toronto has superseded her older sister in the west, Montreal being a seaport, and situated in a commanding position at the foot of the great Canadian chain of lake, river and canal navigation, must always hold a large share of her former unrivalled supremacy.

The harbour of Montreal is 630 miles from the sea, and 90 miles above the influence of the tides, but yet it can be entered by vessels of over 4000 tons burden. The quays are built of stone, and taken in conjunction with the locks and wharves of the Lachine canal, also of stone, present a mass of masonry extending for miles. The best view to be had of Montreal is from the mountain, which rises a little westward of the City,





DOMINION OF CANADA.

and along the sides of which, many beautiful residences have been erected. On the streets of Montreal are to be met thousands of persons who cannot speak English, and thousands more who cannot speak French. On every side, also, is to be seen a mixing of the ancient with the modern. Although the place is but two centuries old, this latter characteristic can be noticed in a marked degree and arises largely from the disinclination to change on the part of the French population, and the introduction of all new improvements and innovations by the other nationalities.

The site of Montreal was first visited on Oct. 2d, 1535 by Jacques Cartier, who found at Hochelaga, an Algonquin Indian Village of 1,200 inhabitants. It was not until 1640, however, that a permanent settlement was established at Montreal. This was at last undertaken by a society formed in Paris and called "La Compagnie de Montreal." This company consisted of about 30 persons and was formed for the promotion of religion in the Colony. The expedition was led by Maisonneuve, a devout soldier, by whose judicious government and courageous tactics, the young Colony of Villemarie, (the ancient name of Montreal), was cherished and protected against the Indians. In 1672 the population of Montreal was 1,500, and about the same time the Village of La Prairie on the opposite side of the river was established by converted Iroquois, who afterwards went further to Caughnawaga, where their descendants still live.

In 1760, Montreal, the last stronghold of the French power in Canada, was surrendered to a British force under command of Sir Jeffrey Amherst in conjunction with General Murray and Col. Haviland, and forced to capitulate. This change from French to English rule did not however impede the progress of the settlement.

The Island of Montreal is exceedingly fertile and is especially famous for its fruit. It is about 32 miles long by 10 broad, and is thickly settled in every section. The Island is formed by the junction of the Ottawa river with the St. Lawrence at St. Anne's in the western extremity, and by the meeting of the same streams at Bout de l'Isle.

There are many pleasant and popular summer resorts near Montreal, of which the chief are Lachine and St. Anne's. St. Lambert and Longueuil are also very popular. Montreal has two parks, a mountain and an island park, the former of which cost \$500,000. The extreme southwestern portion of the City is known as Griffintown, and is inhabited almost exclusively by the Irish element of the population. Griffintown has many factories, shops, schools and public institutions, and is an important business portion of Montreal.

The City possesses over 81 Churches, over 25 Banks about 70 Insurance and Loan Associations, 44 Homes and Asylums, several Hospitals, 33 newspapers and periodicals, of which seven are daily; thirteen Building Societies and a number of literary, scientific and national institutions. The common schools are very numerous, and there are also three Commercial Academies, seven Roman Catholic Convents, Academies and Seminaries; University of McGill College; Victoria University; College of Physicians and Surgeons for Lower Canada; Pharmaceutical Association of Quebec; College of Pharmacy; Methodist and Presbyterian Theological Colleges; St. Mary's of Montreal, R. C. College, and the National Institute of Fine Arts, Sciences and Industries.

The Grand Trunk Railway has its headquarters at Montreal, its chief offices and works being a Point St. Charles. It is here that the Victoria Bridge, across which the railway runs, and which was built by Stephenson, son of the inventor of the steam engine, spans the St. Lawrence. July 20, 1854, witnessed the laying of the first stone of the bridge, and the first train passed over December 10th, 1859. It is 9,184 lineal feet in length, in 24 spans of 242 feet each, and one, the centre, 60 feet above the river, of 350 feet. The cost of this majestic structure was nearly 7,000,000.

By means of this great piece of engineering, the Grand Trunk has an unbroken line of communication between Portland, Me., by way of Riviere du Loup, to Lake Huron and Detroit.

Since the opening of the Canadian Pacific Railway, however, the Grand Trunk has had a rival at Montreal, and one that will stop at no expense to achieve its ends. The fact that the older line has commenced the construction of a double track between certain points lying between Toronto and Montreal with the ultimate intention of laying a double set of rails the whole way, goes to show that it is determined to keep up with the enterprise of the great corporation which has lately linked the two oceans.

Montreal altogether is a majestic City, possessing grand churches and public buildings amidst beautiful surroundings, great commercial facilities, and large wealth. The population now numbers, counting the suburbs, about 200,000 souls.

QUEBEC.

Quebec is the strongest military position in British North America. It is situated 180 miles below Montreal, on a rocky promontory at the junction of the river St. Charles with the St. Lawrence. It is considered by military men to be practically impregnable, although after the Battle on the Plains of Abraham it was given up to Wolfe. The place is divided into two sections, the Upper and Lower towns, the upper being enclosed by fortifications.

Commercially the Lower town is of the greater importance, but in beauty, it is surpassed by the Upper, which possesses squares and public walks, which are exceedingly picturesque. In one of these squares stands a monument erected to the joint memory of Generals Wolfe and Montcalm, both of whom fell at the capture of Quebec in 1759. Another monument stands where Wolfe died on the Plains of Abraham, and an iron pillar on the St. Foy road commemorates the struggle there between the French and British troops in 1760. This monument was presented in 1855 by Napoleon III.

The public buildings of Quebec are numerous and handsome, and include the Legislative buildings, "Spencer Wood" the residence of the Lieut. Governors, Laval University, which cost nearly half a million dollars, the new custom house at Pointe a Carey and many others.

The principal trade of Quebec is ship building and lumbering, but she also does a large business with the surrounding country. The water supply of the city is now taken from lake St. Charles, which has an elevation over the highest buildings in the city and consequently precludes all fear of a repetition of the serious conflagrations which have visited Quebec in years gone by. As a seaport town, Quebec ranks third, Halifax N. S. and St. John N. B. taking the first positions. Opposite the City are two important towns, Pointe Levis and South Quebec, between which and the City communication is kept up by ferries. The Grand Trunk Railway depot is situated at Point Levis, and important works belonging to that company are also located there. Between Quebec and Montreal the steamers belonging to the Richelieu navigation Company ply daily, while other boats make four trips a week to the Saguenay and other watering places. The population of Quebec is between 60,000 and 70,000.

THREE RIVERS.

Three Rivers is the capital of the district of the same name, situated on the north shore of the St. Lawrence, between Montreal and Quebec, and about 60 miles from each city. The chief industry of Three Rivers is lumbering, but it has besides, extensive iron works, a car wheel factory and the largest glove, mitt and moccasin manufactory in the Dominion. Three

Rivers is the seat of a Roman Catholic bishopric, and its Cathedral is one of the finest edifices of its kind in America. The population of Three Rivers is about 15,000.

SHERBROOKE.

The town of Sherbrooke is situated on both banks of the river Magog, at its confluence with the river St. Francis. It is the western terminus of the St. Francis and Lake Megantic International Railway, and is also touched by the Grand Trunk and Mississippi Valley Railway.

Sherbrooke has great water power facilities, which are utilized for woolen, cotton, cloth and flannel factories as well as breweries, saw mills, etc. The population of the place is over 8,000.

ST. HYACINTHE.

The town of St. Hyacinthe with a population of over 5,000, is one of the most flourishing places in the Province. Its markets are excellent, and it does a large local business. The college of St. Hyacinthe is a splendid stone structure over 700 feet long and possessing a fine library, chemical laboratory etc. The Grand Trunk Railway reaches Hyacinthe, which is two hours journey by rail from Montreal and seven from Quebec.

NEW BRUNSWICK.

Champlain first attempted to settle the Province of New Brunswick in 1604, by forming a Colony on St. Croix Island, which ended in failure. Most of the members of the expedition perished from scurvy and the remnant left for Port Royal. Twenty five years after another settlement was made at the mouth of the St. John river, and for some time the fort which was constructed there was commanded by Charles La Tour and did a large trade. Through the treacherous conduct of D'Aulnay Charnisay, another representative of France, La Tour's fort was destroyed, his garrison hung after they had capitulated, and he himself driven into exile.

It was not until 1760 that an English Colony was located on the St. John river. This consisted of a number of families from Massachusetts, who built a fort at the mouth of the Oromocto, 12 miles below where Fredericton now stands.

On May 18, 1783, the City of St. John was founded by a number of loyalists, who had left the United States in order to remain under British rule. The site of St. John had been occupied before this by a few fishermen, but there was no settlement there of any consequence. These loyalists were men of determination and of the right sort to build up a country.

The boundaries of the present Province are as follows: North, Bay Chaleur; East, Gulf of St. Lawrence and Northumberland Straits; South, Bay of Fundy and part of Nova Scotia, and West, State of Maine. The greatest length of New Brunswick, from north to south, is 250 miles; and greatest breadth, 190 miles. It has an area of 27,174 square miles, equal to 17,391,360 acres. The coast line extends about 600 miles, and New Brunswick escapes being an island only by being joined to Nova Scotia by an isthmus eleven miles in breadth. The general surface of the Country is flat or rolling, and there are no mountains of any importance. Some very fine ship harbours are found on the shores of the Gulf of St. Lawrence and Northumberland straits.

The chief river of New Brunswick is the St. J. which is 500 miles in length, and is navigable to steamers of 1,000 tons as far as Fredericton, which place is 90 miles from the sea. Beyond Fredericton small steamers ascend the St. John 65 miles to Woodstock, sometimes as far as Tobique, 75 miles further, and even to the Grand Falls, a cataraet 70 or 80 feet in height, and 225 miles distant from the sea. Above the falls the river is navigable to the mouth of the Madawaska, a distance of 40 miles, and from that point

DOMINION OF CANADA.

boats and canoes can ascend to the sources of the stream. The Madawaska river is also navigable for small steamers to Lake Temiscouata, which is 27 miles long by from 2 to 6 miles wide, and of great depth. The distance from the upper part of this lake to the St. Lawrence is only 18 miles. The St. John river and its tributaries drain some 9,000,000 acres in New Brunswick, 2,000,000 in Quebec and 6,000,000 in Maine.

The next largest river in the Province, is the Miramichi, which flows northeast into a bay of the same name. It is 225 miles long by 7 miles wide at the mouth, and is navigable for large vessels 25 miles from the gulf, for schooners 20 miles further to the head of the tide, and for tow-boats for sixty miles further still. This river has many tributaries.

The rivers Petitcodiac, Richibucto and Restigouche are all fine streams, navigable for from 15 to 25 miles above their outlets, and draining over 8,000 square miles of territory. The Restigouche river is famous in particular for its splendid salmon fisheries.

The most important bay on the New Brunswick coast is that of Chaleur, which is 90 miles in length, and from 12 to 25 in breadth, with many excellent harbours.

The climate of New Brunswick is remarkably healthy, and no diseases peculiar to the locality exist. The scenery also is very attractive and varied in character.

SOIL PRODUCTS.

The soil of New Brunswick is exceedingly rich and productive, and dense forests cover a great portion of the Country. Pine, tamarack, spruce, cedar, and other kinds of timber are found in abundance, and cereals grow well. With the exception of peaches, almost all kinds of fruit thrive, and vegetables produce fine crops. Grass is very largely grown for haymaking purposes, but agriculture is not as yet in a high state of development. The principal line of business followed throughout the interior of the Province is lumbering, while on the coast, thousands of persons live by fishing. There are no finer salmon fisheries in the World than are to be found in New Brunswick, and the Boutouche Carquette, and Cocagne oyster beds are famous everywhere. Lobsters also are captured in these localities in immense quantities.

SHIP BUILDING.

Throughout New Brunswick ship building was once carried on a great deal, especially at St. John and on the Miramichi. St. Andrews and the harbours on the Bay of Fundy were also celebrated for this line of industry. Along the banks of the St. John and Petitcodiac, and at Cocagne, Richibucto, Bathurst, Dalhousie, Campbellton, are found many other ship building ports.

COAL AND MINERALS.

An immense quantity of coal is found in New Brunswick, and the area over which it extends is said to be about 10,000 square miles. Copper, manganese, gypsum, limestone, freestone, grindstone, plumbago and iron, may be mentioned amongst the mineral wealth of New Brunswick.

MANUFACTORIES.

The lines of manufacture which are most produced are lumber, leather, cotton and woollen goods, wooden wares of all kinds, paper, iron castings, nails, mill machinery, and steam engines.

EXPORTS AND IMPORTS.

The chief exports of the province are fish, lumber, iron, coal, gypsum, hay, etc., and the principal imports, wheat, flour, corn meal, corn, grain of all kinds, salted meats, coffee, tea, sugar, molasses, tobacco, woollen, silk and cotton manufactures, fruits, etc. The value of the imports into the province has reached more than \$10,000,000 in one year, the exports aggregating two-thirds of that amount. In one season the imports at the port at St. John have amounted to be-

tween \$8,000,000 and \$9,000,000, while the exports exceeded \$4,000,000.

RAILWAY SYSTEM.

The railway system of New Brunswick stretches all over the Province, and affords connection with all points in other portions of the Dominion, and with the United States. Railway building is also seldom at a standstill, and new lines are constantly being opened.

POPULATION.

In 1851 the population of the Province was 193,800; and in 1881, 321,233 being an increase of nearly 66 per cent. Since then the increase has been fully as great as during the previous twenty years.

SCHOOL SYSTEM.

The school system of New Brunswick is free and non-sectarian, and in addition to Normal, Superior and Common Schools, the Province supports the University of New Brunswick and several colleges.

LANDS.

The terms upon which land is offered to intending settlers is very generous. These are, that a house not less than 16x20 feet be built; that three acres be cleared in one year, and two within three, and that the settler shall reside continually (except unavoidable absences) on the property for three years.

GOVERNMENT.

The government of New Brunswick does not differ materially from that of the sister Provinces. Its affairs are administered by a Lieutenant-Governor, aided by an executive Council of nine members, a Legislative Council of 18 members appointed for life, and a House of Assembly elected for four years. The courts consist of a Supreme Court with a Chief Justice and four Puisne Justices; one of marriage and divorce (which is unknown in Ontario), a Vice-admiralty Court, and a County Court for each County in the Province.

CHIEF CITIES.

The chief cities of New Brunswick are St. John, Fredericton, St. Stephen, St. Andrews, Chatham, Woodstock, Sackville, Newcastle and Moncton.

ST. JOHN.

The City of St. John is situated on the St. John river, 500 miles from its source. It has a population of about 30,000 souls, and is of considerable commercial importance. The harbour of St. John is a very fine one, and is open to navigation during the entire year. The railway system of St. John is also an extensive one, reaching in every direction and communicating with all points, both in Canada and the United States. The fact that St. John harbour is always free of ice is accounted for by the tide falls of the Bay of Fundy, which vary between 21 and 25 feet. The river St. John flows into the harbour through a rocky gorge 90 yards wide and 400 long, about 1½ miles above the city. At low water the river is about 12 feet higher than the harbour, and at high water the harbour is five feet higher than the river. There is, therefore, a fall of water running opposite ways, according to whether the tide is in or out. When the waters of the river and harbour are on a level, which only lasts at one time for a period of 15 or 20 minutes, vessels can pass the falls. The depth of this fall is about 17 feet, and when there is a freshet on the river the tides do not rise to the level of the river, and vessels therefore cannot ascend the stream. A suspension bridge 640 feet in length, or 182 feet shorter than that at Niagara, crosses this rocky gorge about 100 feet above low water; also the magnificent Cantilever Railway Bridge.

The Coldbrook Iron Works and Rolling Mills, the finest in Canada, and also manufactories of edge tools, machinery, steam engines, nails, iron castings, cotton and woollen goods, boots, shoes and leather, wooden ware, soap, candles, carriages, agricultural implements, paper, etc., are located at St. John.

St. John is regularly laid out, the streets running in most cases at right angles to one another, the principal thoroughfares being King and Prince William Sts. Carleton, a well settled section, lies on the western side of the harbour, and forms a portion of the City. The suburb of Portland also joins the City, but is not incorporated with it. St. John is lighted with gas and electric light, has a very efficient fire brigade and a magnificent water supply. The churches, banks, and public buildings of the City are handsome and substantial structures. Among them may be mentioned the Cathedral of the Immaculate Conception, court house, gaol, city hospital, marine hospital, insane asylum and post-office.

MARINE IMPORTANCE OF ST. JOHN.

The position of St. John in regard to her registered shipping, is first of all Cities in the Dominion of Canada, and fourth of all in the British Empire. This fact was established a number of years ago, and as St. John has made great progress since then, it is safe to say that she is holding her own, or perhaps even doing still better. On December 31st, 1874, St. John had 808 vessels measuring 263,410 tons, which gave her the following position amongst other ports of the Empire: Liverpool, 1,411,332 tons; London, 1,096,937 tons; Glasgow, 444,581 tons; St. John, 263,410 tons. This represents a capital of over \$12,000,000, or about \$200 for every inhabitant in St. John County and City.

The lumbering interests of New Brunswick are immense, and to show the magnitude of the trade it is only necessary to instance the case of Alex. Gibson of Nashua, who shipped to Great Britain, Europe and Africa, in the year 1875, 136,000,000 feet of lumber, employing 212 vessels with a capacity of 170,000 tons. During the four seasons previous to 1881 the total amount shipped by Mr. Gibson was 430,000,000 of feet. In the winter season he employs over 1,200 horses and 3,000 men in the woods.

THE GREAT FIRE.

On the 20th of June, 1877, St. John was visited by a most disastrous fire, which before its course was stopped swept away the central business portion of the City, with all the public buildings. Two-fifths of the entire City, comprising an area of 200 acres, was desolated, 1,612 houses were destroyed, 13,000 persons left without homes, and \$27,000,000 worth of property was consumed in nine hours. The misfortune of St. John evoked widespread sympathy, and to her cry for help the most liberal responses were given from all over the Continent. But the spirit of the people of St. John was equal to the emergency, and soon a fairer and a costlier City arose from the ashes of the past.

The City has, since the fire, made material progress, and the evils of the conflagration were only temporary ones which the generous conduct of sister cities and of the country at large quickly alleviated.

FREDERICTON.

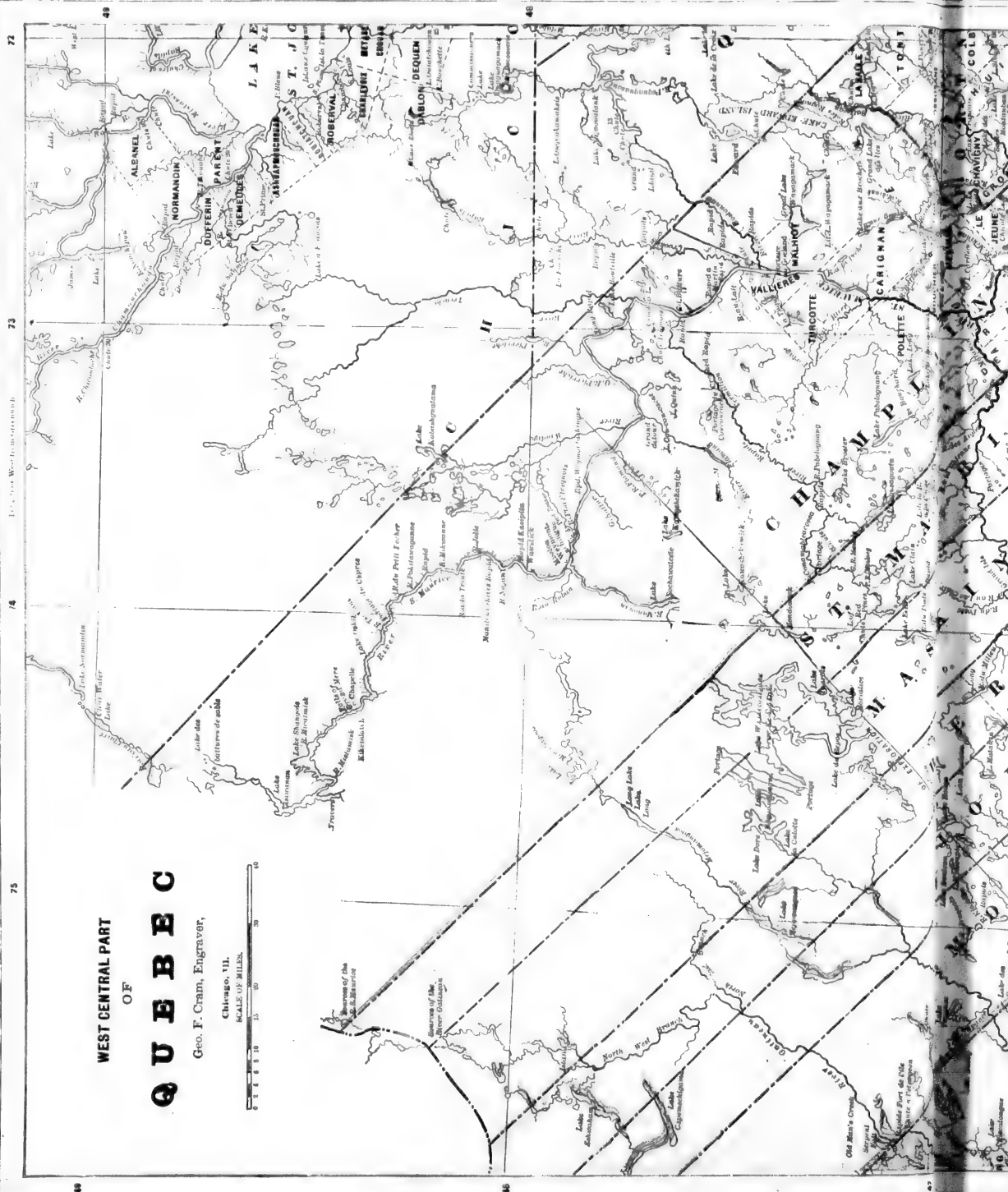
The largest and the most important city in a province or state is not always its capital, and this holds good in respect to New Brunswick. Fredericton, the capital of the Province, is situated on the left bank of the river St. John, 80 miles from the Bay of Fundy, and is regularly laid out. The chief business thoroughfare is Queen street, on which are situated most of the public buildings, banks, hotels, etc. The public buildings on Queen street include the residence of the Lieutenant-Governor. The Parliament buildings, the court-house, city hall and barracks, the last named having accommodation for a regiment of soldiers, and the H. Q. of A. Co. R. S. of Infantry. The depot of the Fredericton railroad stands on York street, and the new Railway bridge across the River St. John has just been completed. The University of Fredericton, a well-endowed and efficient seat of learning, stands on a hill in the rear of the City. There are many fine churches in Fredericton, Christ Church Cathedral being a handsome stone structure, built on the model of the edifice of the same

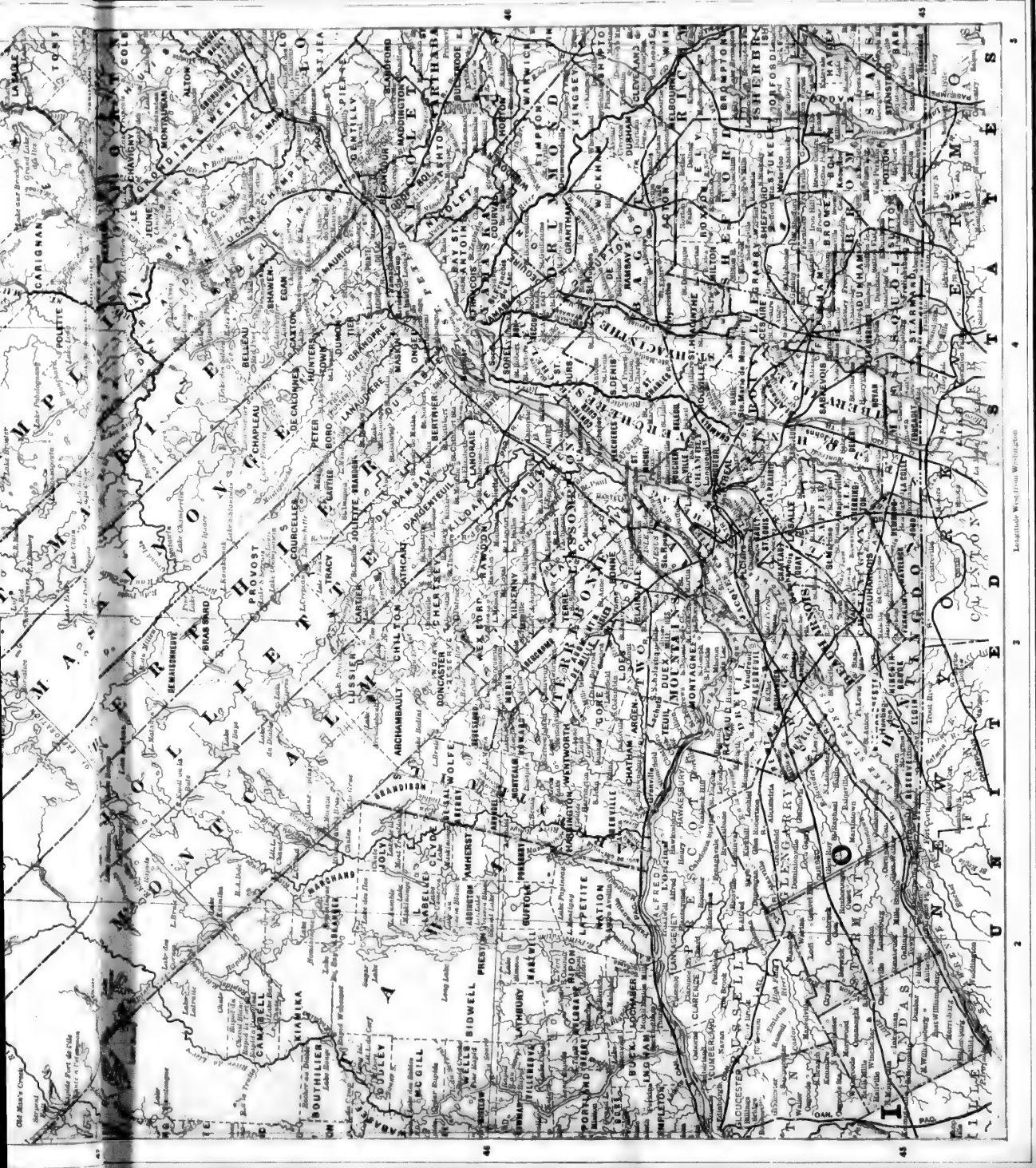
WEST CENTRAL PART OF QUEBEC

Geo. F. Cram, Engraver,

Chicago, Ill.

SCALE OF MILES.





Latitude West from Washington

DOMINION OF CANADA.

name in Montreal. Almost opposite the cathedral is the See House of the Bishop of the diocese.

The river St. John can be navigated by large steamers between the Cities of St. John and Fredericton, and at high water vessels can proceed to Woodstock, Tobique and Grand Falls.

ST. STEPHEN.

The town of St. Stephen is situated on the banks of the river St. Croix, and is connected with Calais, a thriving town in the State of Maine, by a covered bridge. In both these towns lumbering is carried on extensively, and considerable general business is done. The population of St. Stephen, in 1881, was about 3,000.

CHATHAM.

Chatham is a beautiful town on the right bank of the Miramichi river, in the County of Northumberland. It is one of the most prosperous places on the north shore, and does an immense trade in lumber and fish. Steam mills and foundries are located at Chatham, which also possesses many handsome buildings, public and private. Newcastle, the capital of the county, is six miles from Chatham, and the two are connected by a railway. The former place is a station on the Inter-Colonial. The steamers of the Quebec and Gulf Ports Steamship Co. call at Chatham weekly during the season of navigation. The estimated population of the town in 1881 was 5,702.

ST. ANDREWS.

St. Andrews, a town with a population of about 3,000, is picturesquely situated at the mouth of the St. Croix river. It is the capital of the county, and is a pleasant resort for tourists. The harbour of St. Andrews is a good one, and before the revoking of the Reciprocity Treaty with the United States a large trade was done there. With more favorable trade relations St. Andrews would in all probability greatly improve.

WOODSTOCK.

On the banks of the St. John river is situated the incorporated town of Woodstock, in the centre of a rich agricultural district. Woodstock is the capital of the County of Carleton, and has communication by two lines of railway with Fredericton and St. John. Lumbering is also carried on extensively at Woodstock, and an iron mine is being successfully operated. In 1881 the population of Woodstock was 2,487.

NEWCASTLE.

The town of Newcastle lies on the left bank of the Miramichi river, 30 miles from the Gulf of St. Lawrence. It is the capital of the county, and a large trade in lumber and fish is carried on there. Newcastle is also an important ship building port. The oyster and lobster fisheries of Newcastle are also important branches of industry. The town is one of the chief depots of the Intercolonial railroad, and during navigation the steamers of the North Shore and Gulf Ports call there regularly. The population of Newcastle in 1881 was 4,300.

SACKVILLE.

Sackville is situated at the head of the Bay of Fundy, and possesses a good harbour and excellent facilities for ship building. It has also a foundry, which turns out several thousand stoves per annum, a steam tannery, some mills, and several colleges and academies. Sackville, in 1881 had a population of 4,892.

NOVA SCOTIA.

The Province of Nova Scotia was originally called Acadia, and consists of a narrow peninsula, and the island of Cape Breton, which is separated from the mainland by the straits of Canso.

Nova Scotia is bounded on the north by Northumberland Strait (which separates it from Prince Edward Island), and by the Gulf of St. Lawrence; northeast, south, and southeast by the Atlantic Ocean; west by the Bay of Fundy; and north by New Brunswick, with which it is connected by an isthmus 11 miles wide, which separates the Bay of Fundy from Northumberland Strait. The greatest length of the Province from southwest to northeast is 350 miles, and the greatest breadth about 130 miles. It has an area of 20,907 square miles equal to 13,380,480 acres.

The sea coast of the Province for a distance into the country of from 5 to 10 miles is poor soil, although shewing considerable mineral wealth. There are, however, on each side of the Cobequid range of mountains, which run through the centre of the Province, tracts of fine agricultural land which are farmed to advantage. The streams which intersect the country are full of brook trout and salmon, and on the sea coast, cod, haddock, hake, pollock, mackerel, and herring are captured in large quantities.

The climate of Nova Scotia is a healthy one, as the stalwart appearance of the native born population indicates.

The root and vegetable crops produced are very fine, and fruits of all kinds grow and ripen to perfection. Peaches and grapes in some sections ripen in the open air.

As far as disease is concerned, Nova Scotia has a very clean record, and does not suffer from any of those epidemics which are the scourge of some climates.

There are on the southeast coast of Nova Scotia fourteen magnificent harbours within a distance of 110 miles, or between Halifax and Cape Canso. Some fine harbours are also to be found on the southwest and north coasts of the Province.

Cape Breton is also well supplied with harbour facilities, and has a number of large lakes scattered over its surface.

The mineral and coal deposits which are found all over Nova Scotia are very extensive, and the gold taken from the first opening of the mines in 1860 up to 1873 amounted to \$348,000 sterling. The yield since then has been steadily on the increase.

Manufacturing is not very extensively carried on in Nova Scotia at present, although coarse flannels, bed linen, blankets, carpets, and tweeds are made, and tanning is also coming into prominence. In the neighborhood of Halifax, tobacco, printing and wrapping paper, machinery, nails, carriages, gunpowder, pails, etc., are turned out.

THE GOVERNMENT.

Nova Scotia is governed pretty much on the same principles as the other Provinces. There is a Lieut. Governor, an Executive Council of nine members, a Legislative Council of 21 members appointed for life, and a Legislative Assembly elected every four years.

The judicial system consists of a Supreme Court composed of a Chief Justice and nine assistants, a Court of Error, of Vice Admiralty, and of Marriage and Divorce. Each County has also its Court of Probate.

EDUCATION.

Education is free throughout the province. Besides Public Schools and a Normal and Model School, there are the following institutions: Dalhousie College and University; St. Mary's College (Roman Catholic); Presbyterian College, Halifax; Acadia College (Baptist), Wolfville; St. Francis College (Roman Catholic), Antigonish; and King's College and University (Anglican, founded in 1787) Windsor.

There are in Nova Scotia two dioceses of the Church of Rome—the Archdiocese of Halifax and the Diocese of Antigonish; and one Diocese of the Church of England—that of Nova Scotia and Prince Edward Island.

HALIFAX.

The City of Halifax was founded in the year 1749, and received its name in compliment to George Montague, Earl of Halifax, who was the head of the Board of the Lords of Trade, by whom the City was established.

The colony originally consisted of 2,570 persons under the governorship of Col. the Hon. Edward Cornwallis.

During the first seven years of the existence of this settlement the sum of \$500,000 was expended by the British government for its maintenance. Halifax ever since its first settlement has been an important military and naval station, and the only garrison of Imperial troops in the Dominion are now located there.

The harbour of Halifax is considered one of the best in the world. It is easy of access, is large enough to afford anchorage for the united navies of all Europe, and is thoroughly well sheltered at every point. This harbour, after running 15 miles inland, passes the City and then broadens into Bedford Basin, a sheet of water covering nine square miles, with a depth of from four to thirty fathoms of water.

The dockyard of Halifax at the north end of the City covers 14 acres, and is one of the finest in the British Colonies.

Halifax itself is not a manufacturing City, but Dartmouth, its chief suburb, has several large iron foundries and machine shops. Richmond, another suburb, has railway machine shops, tobacco and piano factories, powder mills, nail and cabinet factories, and a variety of industries.

There are also a large number of churches and educational institutions in Halifax, as well as banks, building societies, insurance association, hotels, mercantile establishments and charities.

The railways of the Continent all connect with Halifax, which also has the benefit of open navigation all the year round.

In 1881 the city had a population of 36,054, and it probably now contains between 40 and 50,000 souls.

WINDSOR.

The town of Windsor is situated on the river Avon, at the head of Minas Basin, and in 1881 had a population of 3,019. Ship building is its chief industry, and immense quarries of gypsum also exist in the vicinity. King's College, an important educational institution, was founded here in 1787, and chartered by George III. 1802.

YARMOUTH.

Yarmouth is a ship building and fishing centre of much importance. It is situated on the Atlantic and Northwestern Coast, and is the second port in the Dominion, as regards its registered tonnage of vessels. It has 422 vessels aggregating 124,741 tons, being an average per vessel twice as great as Halifax.

PICTOU.

Pictou is the third City of the Province, is surrounded by fine scenery, has a large harbour, carries on considerable ship building, does a large trade in coal, and possesses many manufacturing industries and fine freestone quarries. It connects by steamship with Montreal, and a ferry runs to Fisher's Grant, the terminus of the Nova Scotia railway.

SYDNEY, C. B.

Sydney was the Seat of Government when Cape Breton Island had a separate existence.

DOMINION OF CANADA.

Its principal trade is in coal, and it is connected by rail with all the chief mines on the Island. Cattle and butter are also articles that are exported largely from Sydney. The population of the place reached 4,000 in 1881.

NEW GLASGOW.

New Glasgow is a station on the Nova Scotia railway, and is situated on the East River, in the County of Pictou. Coal mining and ship building are its chief industries.

OTHER PLACES.

Among the other rising towns of Nova Scotia may be mentioned Amherst, Antigonish, Dartmouth, Liverpool, Lunenburg, Shelburne, and St. Andrews.

PRINCE EDWARD ISLAND.

Prince Edward Island is 130 miles long by 34 broad, and is situated in the Gulf of St. Lawrence. New Brunswick lies to the East, with Northumberland Strait between and Nova Scotia to the south. The area of Prince Edward Island is 2,133 square miles, or 1,365,120 acres. The land is divided by Bays into three distinct Peninsulas, which are called Prince's County, in the West, Queen's County in the centre, and King's County in the East.

The Island was originally covered with dense forests of beech, birch, maple, poplar, spruce, fir, hemlock, larch and cedar, and though many of the trees have been cut down for lumber and destroyed by fire, the country is thickly wooded yet.

The soil is a light reddish loam, and is well suited for agriculture and pasture. No minerals at all have been discovered, and neither limestone nor gypsum. The climate is milder than on the adjoining continent, and the air is clear and healthy. Game and fish are abundant, and Prince Edward Island is popular as a summer resort.

Wheat, barley and oats, are the chief crops, and peas, beans, potatoes and turnips, thrive well. Considerable ship building goes on, and manufacturing for home consumption.

The fisheries on the north coast of the Island are very valuable, cod and mackerel being particularly abundant.

The exports of the Island usually exceed the imports, and it is a remarkable fact that this is the only Province of the Dominion to which this remark applies. The products of the fisheries fluctuate a great deal, varying from a quarter of a million to a million dollars annually.

The principal towns of the Island are the capitals of the three Counties, Charlottetown (Queen's), George town (Queen's), and Summerside (Prince's). These Counties are divided into sixty-seven townships and three royalties, and the inhabitants are of Scotch, Irish, French, English and Acadian descent.

In 1853 the free school system was introduced, and besides the District, Grammar, Normal and Model Schools, there are three Colleges, Prince of Wales, (Protestant) St. Dunstan's, (Roman Catholic) and a Methodist College.

There are two dioceses in the Island, one Church of England, and one Roman Catholic.

Telegraphic communication has been established with the mainland by means of a submarine cable eleven miles in length, which connects the Island with New Brunswick.

A railway to connect Charlottetown with other points on the Island was commenced in 1872, and opened in 1874. It is 201 miles in length.

During the period when navigation is open, steamers run to the Ports of Prince Edward Island from all points. When the Straits are frozen, which, however, is never for very long at a time, mails and passengers

have to be conveyed across on ice-boats. The Government of the Dominion have by the terms of the Union bound themselves to keep navigation open if possible by means of powerful steamers.

The Government of Prince Edward Island is vested in a Lieutenant-Governor, an Executive Council of nine members, a Legislative Council of thirteen members, and a Legislative Assembly.

In 1881 the population of the Island was 108,801—an increase of 38,000 in ten years, and of 104,491 since it became a British possession in 1758.

CHARLOTTETOWN.

Charlottetown is a flourishing place on the north side of the East river. It is the capital of the Island, and boasts of many fine public buildings. It has a fine harbour, and does a good trade, which would be greatly increased by reciprocity with the United States. The population of Charlottetown in 1881 was 11,485.

SUMMERSIDE.

The town of Summerside, the capital of Prince's County, is situated on Bedeque Bay, forty miles northwest of Charlottetown. It has an excellent harbour, and does considerable ship building. It has communication by rail with the rest of the Island, and by steamer with the mainland. The population of Summerside in 1881 was 2,853.

MANITOBA.

On December 1st, 1860, all the vast territories belonging to the Hudson's Bay Co. were transferred to the Dominion of Canada for the sum of £300,000 sterling, and by an order in Council of Her Majesty the Queen, dated June 23d, 1870, were admitted into the federation of Provinces.

The portion of the territories up to that time known as the Selkirk or Red River Settlement, was then formed by the Dominion Government into the Province of Manitoba.

It is bounded on the South by the United States, and on the Northeast and West by the Northwestern Territories. The area of Manitoba, according to the special census of 1886, was 60,520 square miles, or 38,732,000 acres.

Most of the Province is prairie land of exceeding fertility. There is also a certain amount of timber, consisting of elm, oak, ash, poplar, bass wood and maple. All kinds of grain and garden vegetables thrive, and most varieties of fruits also do well.

The climate of Manitoba in winter is clear, cold and dry, and the inhabitants are usually very healthy.

The homestead law of the Province is very liberal, although, of course, land is not so plentiful in Manitoba as it once was, owing to the large influx of settlers from year to year.

Great coal deposits have been discovered on the rivers Saskatchewan and Assiniboine, which will provide fuel for all time to come.

The chief rivers of Manitoba are the Red River and Assiniboine, the former of which rises in Minnesota, and after running northward 700 miles empties into Lake Winnipeg, 105 miles from the boundary. The Assiniboine rises about 400 miles northwest of Winnipeg, and flows 600 miles until it joins the Red River at Fort Garry.

Manitoba, it is scarcely necessary to remark, is at present the most important section of the Canadian Northwest. The completion of the Canadian Pacific Railway gives it direct communication with the Eastern Provinces by an all rail route, and will certainly largely increase the trade of the Province. It is also almost certain that very soon the Province will complete railways of its own to the United States boundary. The wheat export of Manitoba from the harvest of 1887 was 13,000,000 bushels.

WINNIPEG.

The city of Winnipeg is the capital of Manitoba, and was one of the first points settled in the commencement of the present century. It was, however, only a Hudson's Bay fort and trading station until within recent years. In 1870 it was incorporated as a City, and now has a population of about 25,000, and is making substantial progress. What first brought Winnipeg into prominence, as far as the outside world was concerned, was Louis Riel's first rebellion, which was ended by a bloodless military expedition under Col. Wootley, now General Lord Wootley.

The city, in 1882-3, became the victim of a land "boom," which by unduly inflating the value of real estate, had an injurious effect on the progress of the City. The evil results of the boom are, however, fast disappearing.

The City of Winnipeg possesses everything necessary for the capital of a rapidly rising province, and is essentially a progressive modern city, with an active "go-ahead" American element in its midst. The public buildings of Winnipeg are very fine, some of them being exceedingly costly, and the prairie city also has some magnificent private residences.

Outside of Winnipeg the province of Manitoba has a number of towns which are fast rising into prominence. Among them may be mentioned Emerson, which was incorporated as a city some years since; Portage La Prairie, the most important point in Western Manitoba; Rapid City; Selkirk, 24 miles down the river from Winnipeg; Stonewall; St. Andrews; St. Boniface; Blumenort; Gladstone; Headingley; Killdonnan; Morris, and Poplar Point.

THE TERRITORIES.

The Territories of the Dominion of Canada are bounded on the north by the Arctic Ocean, on the east by the Atlantic, on the west by the Pacific, and on the south by the Provinces of Canada and by the United States. A large proportion of this immense area, estimated at 2,955,252 square miles, is rich and fertile, and capable of supporting millions of people.

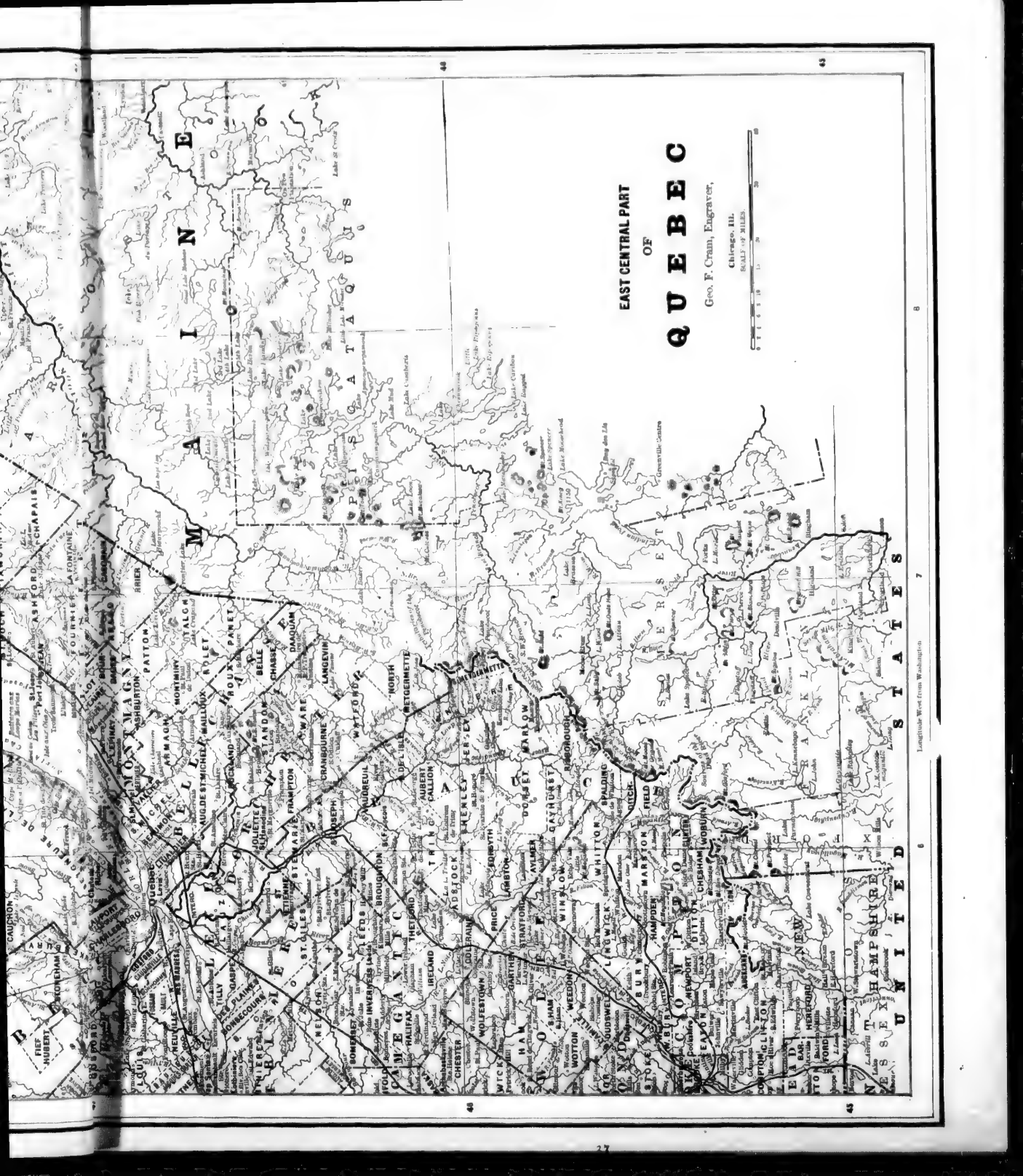
Five Provisional Districts have already been created in the Western Territories. Keewatin was organized and placed under the authority of the Lieutenant Governor of Manitoba. Assiniboia, Saskatchewan, Alberta, and Athabasca were set off in 1882, all, however, remaining under the authority of the Lieutenant Governor and Council of the Northwest Territory, with the seat of government at Regina. The Mounted Police are charged with the preservation of order throughout the Territories. This force was established after Riel's first rebellion, and has done admirable service since in suppressing horse stealing and keeping whisky from the Indians—two of its most important duties. The force at present consists of 1,600 men scattered over a vast extent of country.

In 1885 a special census was taken of Assiniboia, Saskatchewan and Alberta, with the following results: Assiniboia, area, 95,000 square miles; population, 22,063; Saskatchewan, 114,000 square miles; population, 10,746; Alberta, 100,000 square miles; population, 15,583.

The principal rivers in the Northwest Territories are the Churchill, Nelson, Severn, Albany, Great Whale, East Main, and Athabasca, flowing into Hudson's Bay; the Mackenzie, Copper Mine and Great Fish rivers, flowing into the Arctic Ocean; Yukon or Atty flowing into the Pacific; the Saskatchewan, Assiniboine and Red Rivers flowing into Lake Winnipeg; and the Canajousaw and Natwakame rivers, flowing into Hudson's Straits. The Mackenzie is a magnificent river 2,500 miles long.

The chief lakes are the Great Bear, Great Slave, Athabasca, Winnipeg, Macleod, Lake of the Woods, Winnipegosis, Clear Water, Nelson, Deer, Wollaston, North Lined, Mistassini, and Athabasca. Great Slave lake is 800 miles long by 50 broad, and Great Bear is 250 miles long and about the same wide.

The principal settlements in the Territories are, Regina, Medicine Hat, Calgary, Battleford, Edmonton, Duck Lake (where the first encounter with the half breeds in '85 took place), Forts Ellice, McLeod, Pelly, Pitt, Saskatchewan and Vermilion.



EAST CENTRAL PART
OF
QUEBEC

Geo. F. Crann, Engraver,

Chicago, Ill.

SCALE OF MILES



Longitude West from Washington

DOMINION OF CANADA.

BRITISH COLUMBIA.

British Columbia is about 764½ miles long and 400 miles broad, and has, including Vancouver and other Islands, an area of 841,305 square miles. It is bounded on the north by the sixtieth parallel of latitude; on the east by the Rocky Mountains; on the south by the United States, and on the west by Alaska, the Pacific Ocean, and Queen Charlotte's Sound.

A considerable portion of British Columbia is of great fertility, and will produce grains, vegetables, and fruits more freely than any part of Ontario.

The mineral resources of British Columbia are also very great, and gold, silver, and copper are found in large quantities. The gold yield of the Province, from '71 to '81, exceeded \$22,000,000. The coal fields of British Columbia are very extensive, easy of access, and inexhaustible in quantity.

The climate is very mild and pleasant, and animals are able to live without shelter the whole year round.

The area of land fit for agricultural purposes is placed at 200,000 square miles, which is well watered.

The annual product of the fur trade of the country is over \$250,000. Ship building also is likely to become an important branch of industry, and the running of steamers between Hong Kong and other Eastern ports

in connection with the Canadian Pacific Railway at British Columbia, promises to build up for the young Province an important trade.

British Columbia consists of two distinct portions, the Mainland and Vancouver Island. This island is 278 miles long and 40 to 50 wide.

The government of British Columbia consists of a Lieut.-Governor, an Executive Council of five, and a Legislative Assembly elected every four years. The Judiciary consists of a Chief Justice and two assistants. Education is free, and the schools non-sectarian.

Steamers are run continually between British Columbia and San Francisco, and Portland, Oregon.

The colony was first established in 1858, and since the completion of the C. P. R. has been coming forward with rapid strides.

Victoria is the capital, and is situated near the North-East extremity of Vancouver Island. The City is far more advanced than would be expected, considering the age and situation of the colony, and has many handsome public buildings, besides factories and foundries. The probability is that in a few years Victoria will have entirely outgrown the recollection of those who are best acquainted with the place, as it is at present.

New Westminster and Burrard Inlet are two fine Ports, which are also making rapid progress.

NEWFOUNDLAND.

The Island of Newfoundland is not at present a part of the Dominion of Canada. It is situated in the Gulf of St. Lawrence, and lies nearer to Europe than any other part of America. It is about 1,200 miles in circumference, its width at the widest point being 300 miles, and its extreme length, from Cape Race to Gribbet Bay, about 419 miles.

In some sections of the Island agriculture is carried on successfully, but the chief wealth of Newfoundland consists in its minerals and its fisheries. The cod and seal fisheries of the Island are its chief industries, and fish, fish oil, seal oil and skins are its principal exports.

The affairs of Newfoundland are dealt with by a Governor appointed by the Queen; an Executive Council of six members; a Legislative Council of thirteen members, and a Legislative Assembly of thirty-one representatives. The administration of justice is in the hands of a Supreme Court, composed of a Chief Justice and two assistants, a Vice-Admiralty and a District Court.

There are no railways on the Island, and at present its resources cannot be said to be thoroughly developed.

The capital of Newfoundland is St. John's, a City containing some important manufacturing interests, and a population of over 30,000.



DOMINION OF CANADA.

LEGAL AND JUDICIARY.

SUPREME COURT OF THE DOMINION AND COURT OF EXCHEQUER.

The Supreme Court, as a High Court of Appeal, constituted by Dominion Statute, 38 Vic., cap. 2, assented to 8th April, 1875, is composed of a Chief Justice and five Puisne Judges, and has appellate, civil and criminal jurisdiction within and throughout the Dominion of Canada. The Judges reside at Ottawa, where the Supreme Courts holds annually three Sessions—the first beginning on the third Tuesday in February, the second on the first Tuesday in May, and the third on the fourth Tuesday in October. The Exchequer Court, presides over by the same Judges, possesses concurrent original jurisdiction in the Dominion in all cases in which it is sought to enforce any law relating to the revenue, and exclusive original jurisdiction in all cases in which demand is made or relief sought in respect of a suit or action of the Court of Exchequer on its revenue side against the Crown, or any officer of the Crown.

MINISTER OF JUSTICE AND ATTORNEY-GENERAL FOR THE DOMINION OF CANADA.—Hon. J. S. D. Thompson.

Hon. Sir William Johnston Ritchie, Knt., Chief Justice.
Hon. Samuel Henry Strong, Puisne Judge.
Hon. Telephone Fournier, Puisne Judge.
Hon. William Alexander Henry, Puisne Judge.
Hon. Henry Elzeur Taschereau, Puisne Judge.
Hon. John Wellington Gwynne, Puisne Judge.
R. Cassels, Jun., Registrar.

THE LAW SOCIETY OF ONTARIO.

The Law Society was first established in 1797, by the Act 37, Geo. III., c. 13, which enabled the then practitioners of the law to form themselves into a society, and make rules for its government. By the Act of 1822, 2 Geo. IV., c. 5, "the Treasurers and Benchers of the Law Society" were formally incorporated; and under these and other statutes the Society has continued to be governed by a Board of Benchers, in the same manner as the various Law Societies of England. By Revised Statutes of Ontario, c. 138, the Benchers theretofore appointed, from time to time, by their own body, are made exclusive of *ex-officio* members, elective by the Bar, the *ex-officio* consisting of the Attorney-General of the Dominion for the time being, if a member of the Bar of Ontario, and all members of the Bar of Ontario who have at any time held the office of Attorney-General of the Dominion or of Ontario, or of Attorney or Solicitor-General of the former Province of Upper Canada, and any retired Judge of the Superior Courts of Law or Equity of Ontario; the *elective*, thirty in number, being chosen by the ballot, for a term of five years, by the members of the Bar, in manner prescribed by the Act. Vacancies during the term are filled by the remaining Benchers. On the first day of Easter Term, annually, the Benchers appoint one of their body to be Treasurer, who is also President of the Society. The Benchers sit in Convocation every term for the call of Barristers, the admission of Attorneys and Solicitors to Practice, and of Students to enter the Society, the fees paid by whom form the revenue of the Society. Osgoode Hall, appropriately named after the first Chief Justice, is the Ontario "Inn of Court," or headquarters of the Society, in which is provided accommodation for the Court of Appeal and Courts of Equity, and for the sittings in term of the Superior Courts; with a valuable and extensive library.

VISITORS.

The several Judges of the Supreme Court of Judicature for Ontario.

Treasurer.—Hon. Edward Blake, M. A., Q. C., M. P.

BENCHERS.

Ex-officio.—Right Hon. Sir John A. Macdonald, K. C. B., D. C. L., Q. C., Atty.-Gen., 1864; Hon. Jas. Patton, Q. C., Sol.-Gen. 1862; Hon. A. N. Richards, Q. C., Sol.-

Gen. 1864; Hon. Oliver Mowat, Q. C., retired Vice-Chancellor, 1872, present Atty.-Gen. Ontario; Hon. Edward Blake, Q. C., late Minister of Justice and Atty.-Gen. of the Dominion; Hon. Sir Alexander Campbell, K. C. M. G., Q. C., late Minister of Justice; Hon. Samuel Hume Blake, retired Vice-Chancellor, 1881; Hon. Sir Adam Wilson, Kt., retired Chief Justice, 1887.

Elective.—E. T. 1881—E. T. 1886—James Beaty, Jun., Q. C., M. P., Toronto; John Bell, Q. C., Belleville; B. M. Britton, M. A., Q. C., Kingston; Hector Cameron, M. A., Q. C., M. P., Toronto; J. Harry Ferguson, Toronto; James J. Foy, Q. C., Toronto; Hon. C. F. Fraser, Q. C., M. P., Brockville; D. Guthrie, Q. C., Guelph; Hon. A. S. Hardy, Q. C., Brantford; J. Hoskin, Q. C., Toronto; A. Hudspeth, Q. C., Lindsay; J. E. Irving, Q. C., Hamilton; J. K. Kerr, Q. C., Toronto; Z. A. Lash, Q. C., Toronto; James H. Morris, Q. C., Toronto; Huxon W. M. Murray, Toronto; E. Martin, Q. C., Hamilton; W. B. Meredith, L. L. B., Q. C., M. P. P., London; Jas. MacLennan, M. A., Q. C., Toronto; D'Alton McCarthy, Q. C., M. P., Toronto; F. McKelcan, Q. C., Hamilton; D. McMichael, L. L. D., Q. C., Toronto; Charles Moss, Q. C., Toronto; B. B. Osler, Q. C., Toronto; Hon. T. B. Pardee, Q. C., M. P. P., Sarnia; T. H. Purdon, London; C. Robinson, Q. C., Toronto; L. W. Smith, D. C. L., Toronto.

Secretary, Sub-Treasurer and Librarian—J. H. Eaten, Barrister-at-Law; Senior Assistant, C. B. Grasset; Junior Assistant, J. J. Daley.

EXAMINERS.—Equity, P. H. Drayton; Criminal Law and Torts, W. A. Reeve, Q. C.; Real Property, E. D. Armour; Mercantile Law, Z. E. Kingsford.

THE SUPREME COURT OF JUDICATURE FOR ONTARIO.

COURT OF APPEAL FOR ONTARIO.—Constituted for the hearing of appeals in civil cases from the Queen's Bench, Chancery, and Common Pleas Divisions of the High Court of Justice, and from the County; and by recent Statute, the Division Courts also in cases defined as to amount, and appeals from criminal cases from the Queen's Bench, Common Pleas and County Courts. From the judgment of this Court an appeal lies, at the option of litigants, either to the Supreme Court of the Dominion, or to Her Majesty in Privy Council, in cases over £1,000, or where annual rent, fee, or future rights of any amount, are affected. The Judges of this Court, in addition to their appellate duties proper, take part in presiding over Courts of Oyer and Terminer and General Jail Delivery and sittings of the Queen's Bench, Chancery and Common Pleas Divisions of the High Court of Justice, and may be placed on the rota for the trial of Election petitions, with the Justices of the High Court, who, as *ex-officio* Judges of this Court, choose from their number a Judge or Judges, to sit in Appeal in case of there being a vacancy in this Court, or if, from illness or some other cause, one of the Judges of the Court is unable to be present, or is under any legal disqualification to hear an appeal. *Chief Justice of Ontario*—Hon. John Hawkins Haggarty, D. C. L. *Justices of Appeal*—Hon. G. W. Burton, Hon. Christopher S. Patterson, Hon. F. Osler. *Registrar*—Alexander Grant.

HIGH COURT OF JUSTICE FOR ONTARIO.

QUEEN'S BENCH DIVISION.—The jurisdiction of this Division extends to all manner of actions, causes and suits, criminal and civil, real, personal and mixed, within Ontario, and it may proceed in such, by such process and course as are provided by law, and as shall tend with justice and despatch to determine the same; and may hear and determine all issues of law, and also (with the inquest of twelve good and lawful men in the cases provided for) try all issues of fact, and give judgment, and award execution thereon, and also in matters which relate to the Queen's Revenue (including the condemnation of contraband or smuggled goods) as may be done by Her Majesty's Superior Courts of Law in Eng-

land. *Chief Justice*—Hon. J. D. Armour. *Members of the Queen's Bench Division*—Hon. W. G. Falconbridge, Hon. W. P. R. Street. *Registrar*—Jas. S. Cartwright.

CHANCERY DIVISION.—This Division has the like jurisdiction as the Court of Chancery in England, in cases of fraud, accident, trusts, executors, administrators, co-partnerships, accounts, mortgages, yardslower, infants, idiots, lunatics and their estates, waste, specific performance, discovery, and to prevent multiplicity of suits, and may decree the issue, repeal, or avoidance of letters patent, and generally the like powers which the Court of Chancery in England possesses to administer justice in all cases in which there is no adequate remedy at law. *Chancellor*—Hon. John A. Boyd. *Members of the Division*—Hon. Wm. Proudfoot and Hon. Thomas Ferguson. *Special Examiners*—Geo. M. Evans, W. D. Gwynne, and Shorthand only, John Bruce. *Registrar*—G. S. Holmsted. *Assistant Registrar*—A. F. McLean. *Clerk of Records and Writs*—G. M. Lee, *Docketing Clerk*—A. J. Elliott.

COMMON PLEAS DIVISION.—This Division has the same power and jurisdiction as a Court of Record, as the Queen's Bench Division. Writs of summons and capias issue alternately from either Division. *Chief Justice*—Hon. T. Galt. *Members of the Division*—Hon. John E. Rose, Hon. Hugh MacMahon. *Registrar*—M. B. Jackson.

All Divisions of the High Court have now concurrent jurisdiction under the Judicature Act, 1881.

CHAMBERS.—Chambers are held each day for such business relating to actions as may be transacted by a single Judge out of Court. The Master in Chambers is empowered to obtain the assistance of the Registrar of the Queen's Bench Division or of any official Referee to sit with or for him. *Master in Chambers*—R. G. Dalton, Q. C. *Clerks*—F. Arnoldi and A. Y. Blain.

MASTER'S OFFICE.—*Master in Ordinary of the Supreme Court*—Thos. Hodgins, Q. C. *Clerk*—N. McLean.

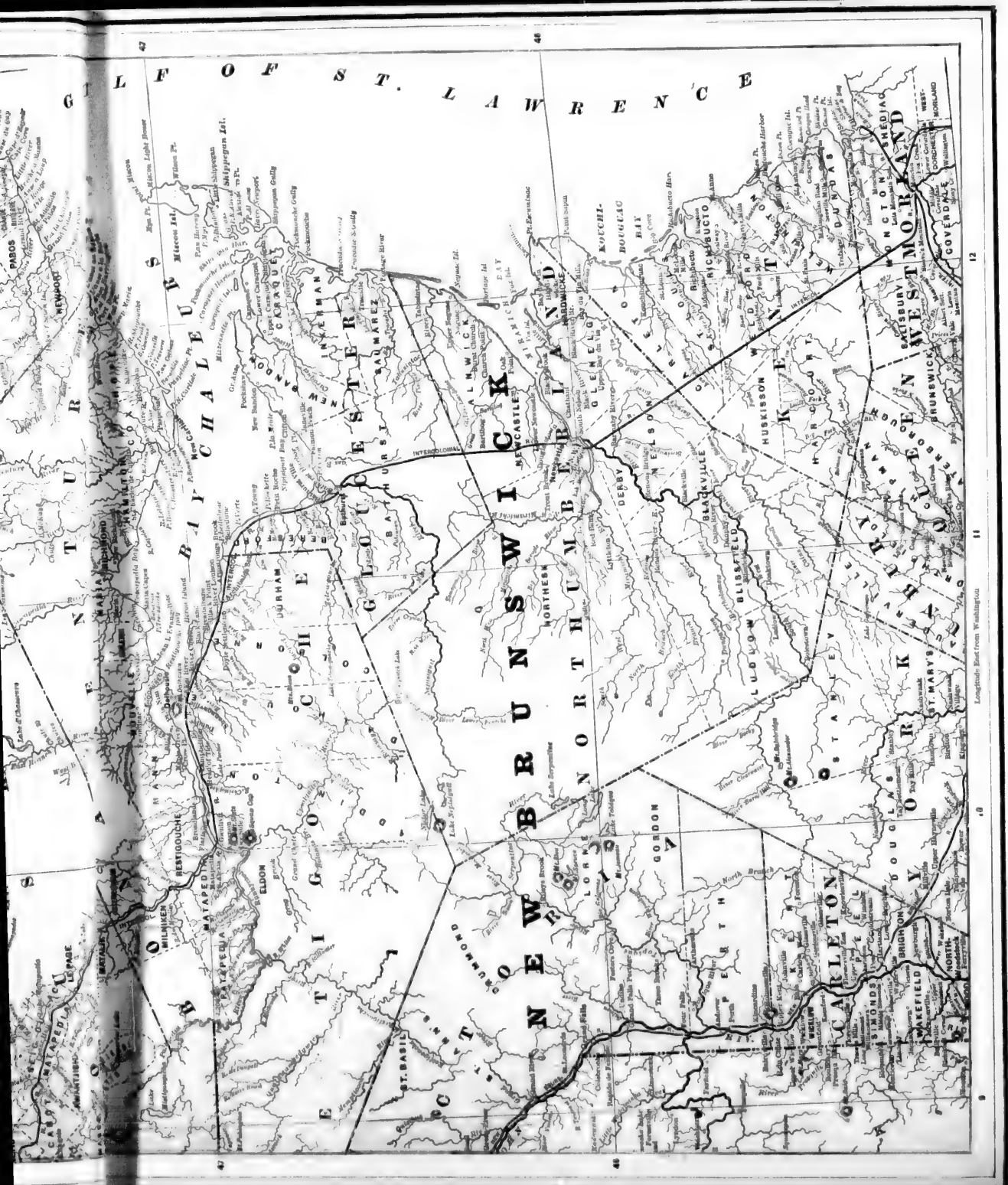
ACCOUNTANT'S OFFICE.—*Accountant*—Geo. S. Holmsted. *Clerk of Accounts*—Benj. W. Murray. *Clerks*—Geo. Behan, E. J. Harding, Miss M. Buchan and C. Gilbert.

TAXING OFFICERS.—J. H. Thom and S. B. Clark.

MARITIME COURT OF ONTARIO.—Constituted by Dominion Statute, 46 Vic., cap. 21, as a Superior Court of Maritime Jurisdiction; is composed of one Judge for the whole Province, and Surrogate Judges for certain localities appointed by the Governor in Council, are invested with such powers as may be conferred on them by their commission. The Maritime Court is a Superior Court of Record, having, with some exceptions mentioned in the Act, the like rights and remedies in all matters including cases of Contract and Tort, and proceedings *in rem* and *in personam*, arising out of or connected with navigation, shipping, trade or commerce, on any river, lake, canal, or inland water, of which the whole or part is in the Province of Ontario, as any existing Vice-Admiralty Court would have if its process extended to the Province of Ontario. The sittings of the Court and in Chambers are fixed and regulated by the Judge and Surrogate Judges at such times as they shall think fit and necessary for the due administration of justice. *Judge for the whole Province*—Hon. John Boyd. *Registrar*—John Bruce. *Marshal*—Wm. Boyd.

REPORTERS.—*Editor*—James F. Smith, Q. C. *Reporter in Queen's Bench*—S. J. Vankoughnet. *Reporter in Common Pleas*—G. F. Harman. *Reporters in Chancery*—G. A. Boomer, A. H. F. Lefroy. *Reporter of Appeal*—A. Grant. *In Chambers*—T. T. Rolph. *Distributor of Law Stamps*—W. W. Baldwin.

HEIR AND DEVISEE COURT.—Commissioners, the Judges of the Superior Courts, and such other persons as may be appointed by commission under the Great Seal. Their duties are to determine claims to lands in Ontario,



DOMINION OF CANADA.

for which no patent has issued from the Crown in favour of the proper claimants, whether as heirs, devisees or assignees. *Sittings at Toronto, first Monday in January and July in each year. Clerk of Commissioners—W. B. Howard.*

COURT FOR THE TRIAL OF CONTESTED ELECTIONS.—The nature of these courts is sufficiently indicated in their title. In respect to elections for the House of Commons of Canada, the Superior Courts, by one of their Judges appointed in that behalf, are invested with special jurisdiction for the trial of contested elections, and appeals lie to the Supreme Court at Ottawa. In respect to elections for the Local Legislature of Ontario, the Judges of the Court of Appeal and of the Superior Courts of Law and Equity meet annually in Michaelmas Term and severally select, by a majority of votes, a Judge of their respective Courts to be placed on the rota for the trial of election petitions. In the case of death or the illness of a Judge so chosen, the Court of which he is a member meet and elect another Judge. Trials involving corrupt practices are presided over by two Judges, otherwise a single Judge presides, and an appeal lies to the Court of Appeal of the Province.

COUNTY COURTS.—Presided over by a resident Judge in each county, assisted in some counties by a Deputy or Junior Judge. Their jurisdiction extends to all personal actions where the debt or damages claimed do not exceed \$200; and to all suits relating to debt, covenant or contract, where the amount is ascertained by the acts of the parties or signature of the defendant, to \$400; and to all bail bonds and recognizances of bail given in the County Court, to any amount; but not to cases involving the title to lands, validity of wills, or actions for libel, slander, crim. con., or seduction. An appeal lies to the Court of Appeal of Ontario.

COUNTY COURT SITTINGS AND COURT OF GENERAL SESSIONS.—The County Judge in each county holds a sitting of his Court and a Court of General Sessions in his county semi-annually on the second Tuesday in June and December, except in the County of York, in which county said Court is held four times, commencing on the first Tuesday in December and March, and the second Tuesday in May and September, the latter Courts for the trial of cases of felony and misdemeanor, but treason and capital felonies are exempted from their jurisdiction. The Judge may also, in his discretion, hold additional sittings at such times as may be deemed expedient to expedite business, but only for the trial of issues of fact without a jury.

COUNTY JUDGES' CRIMINAL COURT.—Persons committed to jail for trial, on charge of being guilty of any offence for which they may be tried at a Court of General Sessions may, with their own consent, and subject to the provisions of the Act in that behalf, be forthwith tried by the Judge of the County Court and General Sessions without a jury, and if convicted, be sentenced by the said Judge; and the Judge sitting on any such trial for all the purposes thereof, is constituted a Court of Record, and the record in any such case shall be filed among the records of the Court of General Sessions last mentioned.

COURTS OF REVISION.—The County Judges hold annually Courts of final revision of the Assessment Rolls of each Municipality, being in the light of Courts of Appeal from the first Court of Revision held by the Municipality; and also Courts for the Revision of the Voters' Lists for Provincial elections. The Voters' Lists for Dominion Elections are now settled by Revising Barristers under the Act of 1885.

INSOLVENT DEBTORS' COURTS.—These Courts, which had reference to traders only, were regulated by the Act known as the "Insolvent Act of 1875." This Statute has now been repealed, and the Courts and Assignees are only continuing to wind up pending cases.

SURROGATE COURTS.—The jurisdiction of these Courts relates to all testamentary matters and causes,

and to the granting and revoking of probate of wills, and letters of administration of the effects of deceased persons having estate or effect in Ontario, and all matters arising out of or connected with the grant or revocation of probate or administration, subject to an appeal to the Chancery Division. The County Judges are also Judges of the Surrogate Courts. *Chief Surrogate Clerk at Toronto—Sir T. L. Robinson, Bart. Assistant—F. A. Robinson.*

DIVISION COURTS, for the summary disposal of cases by the presiding Judge, being the County Judge or his Deputy, or any Barrister appointed to hold the same; but a jury of five persons may be demanded in certain cases. Their jurisdiction extends to actions of debt or contract where the balance claimed is over \$100 and under \$200 and the original amount was ascertained by the signature of the defendant, and to \$100 in other cases of debt, subject to an appeal to the Court of Appeal; but the sum of the account to be gone into cannot exceed \$400; injuries or torts to personal chattels amounting to \$50; and personal actions to that amount, if not excepted from their jurisdiction; but not to actions for gambling debts, liquors drunk in a tavern, or notes of hand given therefor, ejectment, title to land, &c., or any toll, custom or franchise, will or settlement, malicious prosecution, libel, slander, crim. con., seduction or breach of promise, or actions against a J. P. for anything done by him in the execution of his office, if he objects to it. Each Judicial District is divided into Court Divisions, and Courts are held once in two months in each Division, or oftener at the discretion of the Judge. The Divisions are established by the Courts of General Sessions, and in certain cases by the Judges.

BOARD OF COUNTY JUDGES.—*Chairman—J. R. Gowan, late sen. Judge County Simcoe. Members—S. J. Jones, County Brant; D. J. Hughes, County Elgin; James Daniell, Counties Prescott and Russell; and J. S. Sinclair, County Wentworth.*

CRIMINAL LAW OFFICERS.

ATTORNEY GENERAL FOR THE PROVINCE OF ONTARIO—HOB. O. MOWAT, Q. C.

OFFICERS OF THE COURTS.

OFFICIAL GUARDIAN.—John Hoskins, Q. C.

SENIOR JUDGMENT CLERK.—G. S. Holmsted.

JUNIOR JUDGMENT CLERK.—A. F. McLean.

INSPECTOR OF TITLES AND REFEREE OF TITLES AT TORONTO.—C. S. Holmsted.

INSPECTOR OF LOCAL OFFICES.—M. B. Jackson.

OFFICIAL REFEREE (EX OFFICIO).—The Master in Ordinary of the Superior Court, the Registrar of the Queen's Bench Division, the Registrar of the Common Pleas Division, the Referee in Chambers (vacant), the Accountant, the Inspector of Titles, and the Referee of Titles.

CLERK OF ASSIZE.—High Court of Justice, G. B. Nicol, Toronto.

DEPUTY CLERKS OF THE CROWN.—The Clerks of the County Courts will be *ex-officio* Deputy Clerks of the Crown and Pleas of the several Counties as the present incumbents vacate by death or otherwise.

CLERK OF THE PROCESS.—For Sealing and issuing Writs of Summons and other Writs in the Queen's Bench, Chancery and Common Pleas Divisions (alternately), W. B. Howard. *Assistant—C. A. Stewart.*

INSPECTOR OF PUBLIC OFFICES.—John Winchester, Clerk—W. O'Neill.

SITTINGS OF THE COURTS.

COURT OF APPEAL.—This Court holds its sittings at such time and for such periods as the Judges shall, from time to time, deem necessary or convenient for the speedy dispatch of business, the times now fixed being the first Tuesday in March and September, and the second Tuesdays in January, May and November; notice of the holdings of such sittings being given according to the usual practice.

SITTINGS OF THE QUEEN'S BENCH AND COMMON PLEAS DIVISIONS.—Hilary begins first Monday in

February, and ends Saturday of the ensuing week, Easter begins third Monday in May and ends Saturday of the second week thereafter; Michaelmas begins third Monday in November and ends Saturday of the second week thereafter. Trinity Term begins on the Monday after the 21st August, and ends on Saturday of the following week, but may be dispensed with by order of Court. The Queen's Bench and Common Pleas Divisions have power also, at their discretion, to hold divisions in banco in time of vacation (except long vacation), by virtue of a rule or order of the Court, respectively to be made in or out of term, for the hearing of such special cases or rules for new trials as shall be named in a list to be attached to any such rule or order, and for giving of judgment in cases previously argued, and for disposing of such other business as the Court in its discretion shall see fit; and one of the Judges of either of the said Divisions sits in open Court on Tuesday and Friday of every week, as well in as out of Term, except during vacation, for the purpose of disposing of all Court business which may be transacted by a single Judge.

CHANCERY SITTINGS.—*Sittings for the hearing of causes, including examination of witnesses, are held twice in each year, at Toronto, and on Circuit, the places and dates being previously arranged by the Judges (see Circuits). Sittings for the rehearing of causes, are held on the 3d Thursday in February, the last Thursday in August, and the 1st Thursday in December. The Court sits every week, except during vacation, for the despatch of business, in the following order: Monday, Chamber business; Tuesday, motions; Wednesday, motions for judgment, further directions, petitions and demurrers; Thursday, appeals from Master's reports.*

LONG VACATION extends from the 1st of July to the 1st of September. In Chancery, there is also a vacation from the 24th December to 6th January.

COUNTY COURTS TERMS.—The several County Courts in Ontario hold four sittings in each year, commencing respectively on the first Monday in the months of January, April, July, and October, except the County of York, which commences on the first Monday in January and April, and the second Monday in June and October, and ending on the Saturday of the same week.

CIRCUITS OF THE COURTS.

LAW CIRCUITS.—*Sittings for Hearing of Actions.*—Courts of Oyer and Terminer and General Goal Delivery are held twice a year in each County or union of Counties, in the vacation between Hilary and Easter Terms, and between the period of the vacation after the 21st of August and Michaelmas and Term, except the Counties York and Wentworth. In each of which Counties there is held a third such Court in every year, in the vacation between Michaelmas and Hilary Terms; and in the County of York there is held a fourth such Court, between Easter Term and the first day of July. The sittings for hearing of actions may, in the direction of Judges, be held separate and apart from the Courts of Oyer and Terminer, and General Goal Delivery and the Assizes for any County are not put an end to by the commencement of Term, but may continue and be held during Term, subject to special rules in such case for moving against the verdict or for new trials. There are six Circuits as follows, viz:—

Eastern: Brockville, Cornwall, Kingston, L'Orignal, Ottawa, Pembroke, Perth, Midland: Belleville, Cobourg, Lindsay, Napanee, Peterborough, Picton, Whitby. *Niagara:* Barrie, Hamilton, Orangeville, Owen Sound, St. Catharines, Welland. *Oxford:* Berlin, Brantford, Cayuga, Guelph, Simcoe, Stratford, Woodstock. *Western:* Chatham, Goderich, London, Sandwich, Sarnia, St. Thomas, Walkerton. *Home:* Brant, Milton, Toronto.

The Courts in each Circuit shall be presided over by one of the Chief Justices or Justices of the High Court or of the Courts of Appeal, or, in their absence, by a

DOMINION OF CANADA.

Judge of the County Court, or some one of Her Majesty's Counsel learned in the law, requested by any one of the Chief Justices or Justices to act in that behalf.

CHANCERY CIRCUITS, for the Examination of Witnesses and Hearing Causes, are held in the Spring and the Fall of each year as follows:—

TORONTO:—Toronto, Eastern: Belleville, Brockville, Cobourg, Cornwall, Kingston, Lindsay, Ottawa, Peterboro'. Western: Chatham, Goderich, London, Sandwich, Sarnia, Stratford, Walkerton, Woodstock, *Homes*: Barrie, Brantford, Guelph, Hamilton, Owen Sound, Simcoe, St. Catharines, Whitby.

The Courts in each Circuit are presided over by the Chancellor or one of the Members of the Chancery Division, or by a retired or present Justice of the High Court or of the Court of Appeal, or by Judge of a County Court, or by some one of Her Majesty's Counsel learned in the law, requested by the Chancellor or one of the Justices to act in that behalf.

MASTER OF TITLES, under Land Title Act, 1885, (Torrens Act), J. G. Scott, Q. C. Clerk, W. B. McTavish,

Province of Quebec

QUEEN'S BENCH.

CHIEF JUSTICE.—Hon. Sir Aime A. Dorion.
PEINCE JUDGES.—Hons. Samuel Cornwallis Monk, Thos. K. Ramsey, Ulric J. Tessier, Alex. Cross, George Baby.

CLERK OF APPEALS.—L. T. W. Marchand.
DEPUTY CLERK OF APPEALS AND CLERK OF THE CROWN AT QUEBEC.—Louis Oulmet.

SPECIAL DEPUTY CLERK AT QUEBEC.—A. Dorval.
CLERK OF THE CROWN AND PLACE AT MONTREAL.—Schiller & Sciotte.

CLERK OF THE PEACE AT QUEBEC.—Dennis Lauray.

SUPERIOR COURT.

DISTRICTS	JUDGES.	PROTHONOTARIES AND CLERKS OF CIVIL COURTS.
Arthabaska.....	Hon. M. A. Plamondon	
Beauce.....	" A. R. Angers... Z. Vezina	
Beauharnois.....	" Louis Belanger, C. Durand	
Bedford.....	" G. C. V. Buchanan, Hall & Leonard	
Chicoutimi.....	" A. B. Routhier... F. X. Gosselin	
Gaspe.....	" J. E. LaRue... J. X. Larvie	
Gaspe.....	" J. E. LaRue... J. F. McGuire	
Iberville.....	" H. W. Chagnon, F. J. Marchand	
Joliette.....	" H. T. Taschereau, Durocher & D'Alles	
Kamouraska.....	" E. Cimon... J. C. Pelletier	
Montmagny.....	" A. B. Angers... A. Bender	
Montreal.....	" F. G. Johnson	
".....	" R. Mackay...	
".....	" F. W. Torrance	
".....	" H. F. Rainville	
".....	" A. C. Papineau	
".....	" L. A. Jette	
".....	" M. Doherty...	
".....	" C. Gill	
".....	" M. Mathieu...	
".....	" L. O. Loranger	
Ottawa & Co.	" J. S. C. Wurtelle, A. Driscoll	
Quebec.....	" A. Stuart, Ch. J.	
".....	" N. Casault...	
".....	" L. B. Caron...	
".....	" L. W. Anderson	
Richelieu.....	" J. A. Oulmet... A. N. Gouin	
Rimouski.....	" H. C. Pelletier... Letendre & Chamberland	
Saguenay.....	" A. B. Routhier... C. Duberger	
St. Francis.....	" E. T. Houches... Short & Cabana	
St. Hyacinthe.....	" L. V. Sciotte... Roy & Riher	
Terrebonne.....	" L. Belanger... Chas. de Montigny	
Three Rivers.....	" J. B. Bourgeois, A. Desjars	

Honey & Getz Iron

JUDGE OF THE SESSIONS OF THE PEACE.—Hon. Alexander Channace, Quebec; M. C. Desnoyers, Esq., Montreal.

JUDGE OF THE ADMIRALTY.—Hon. George Irvine. *Registrar*—James Dunbar, Q. C. *Marshal*—J. B. Parkin, Esq.

Province of New Brunswick.

SUPREME COURT JUDGES.—Hon. John C. Allen, Chief Justice; Hons. A. Rainsford Wetmore, A. L. Palmer, George E. King, John J. Fraser, William H. Tuck.

CLERK OF THE PEACE.—T. Carleton Allen.
COUNTY COURT JUDGES.—Hon. James G. Stevens, William Wedderburn, James Steadman, Bliss Betsford, William Wilkinson, Charles Walters.

CLERKS OF THE COURTS.

COUNTY.	CLERK.
Albert.....	Samuel G. Morse.
Carleton.....	William M. Connell.
".....	A. B. Connell, (Circuits.)
Charlotte.....	George S. Grimmer.
Gloucester.....	Theophilus DesBrisay.
Kent.....	James D. Phinney.
".....	Robert Hutchinson, (Circuits.)
King's.....	Ora P. King.
".....	John H. Cother, (Circuits.)
Madawaska.....	Barry R. Plant.
Northumberland.....	Samuel Thomson.
Queen's.....	James R. Carry.
".....	T. Medley Wetmore, (Circuits.)
Redigonche.....	James S. Morse.
St. John's.....	Mont. McDonald.
".....	John Willett, (Circuits.)
Sanbury.....	George J. Bliss.
".....	Chas. W. Beckwith, (Circuits.)
Victoria.....	Dennis B. Gallagher.
".....	W. Fred. Kerton, (Circuits.)
Westmoreland.....	Joseph B. Peck.
".....	Barry R. Smith, (Circuits.)
York.....	Jeremiah H. Barry.
".....	J. F. McManus, (Circuits.)

Province of Nova Scotia.

JUDGES SUPERIOR COURT.

Chief Justice.—Hon. James McDonald.
Judge in Equity.—Hon. Alexander James.
ASSISTANT SUPERIOR COURT JUDGES.
Hon. Hugh McDonald, Hon. Henry W. Smith, Hon. Robert L. Weatherhse, Hon. J. Norman Ritchie, Hon. Chas. J. Ivershend.

Judges of County Courts.
District No 1, County of Halifax.—James W. Johnstone, Judge.

District No. 2, Counties of Lunenburg, Queens and Shelburne.—Judge Mather B. DesBrisay; also Revising Barrister.

District No. 3, Counties of Annapolis, Yarmouth and Digby.—Judge Alfred W. Savary, also Revising Barrister.

District No. 4, Counties of King, Hants and Colchester.—Judge George A. Blanchard, Esq.; also Revising Barrister.

District No. 5, Counties of Cumberland and Pictou.—Judge William A. D. Morse, also Revising Barrister.

District No. 6, Counties of Antigonish, Guirbore and Inverness, C. B.—Judge Angus McWane.

District No. 7, Counties of Victoria, Cape Breton and Richmond.—all in Island of Cape Breton.—Judge Barclay, E. Tremain, also Revising Barrister.

These Judges hold Courts in their own districts, but on account of the absence, illness, or any other disability of the Judge of another district, they may be called in and try cases in other districts.

Prince Edward Island.

SUPERIOR COURT JUDGES.—Hon. Ed. Palmer, Chief Justice; Hons. Horsefield Peters and Joseph Hensley, Assistant Judges.

COUNTY COURT JUDGES.—Geo. Alley, Esq., Queen's County; Dennis O'M. Reddin, Esq., King's County; Thomas Kelly, Esq., Prince County.

CLERK OF THE CROWN AND PROTHONOTARY.—Rob't T. Weeks.

DEPUTY PROTHONOTARIES.—J. A. Longworth, Queen's County; Wm. Sanderson, King's County; Wm. T. Hunt, Prince County.

CLERKS, C. C.—F. W. Hughes, Chief Clerk, Charlottetown, Queen's County; George A. Aitken, Chief Clerk, Georgetown, King's County; W. T. Hunt, Chief Clerk, Summerside, Prince County.

British Columbia.

CHIEF JUSTICE.—Sir Matthew Baillie Begbie, Kt.
PEINCE JUDGES.—Henry P. P. Crease, Jno. Hamilton Gray, John Foster McCraith, George A. Walkem.
REGISTRAR S. C. VICTORIA.—James C. Prevost.

Province of Manitoba.

QUEEN'S BENCH.

Lewis Wallbridge, Chief Justice, Winnipeg.
Joseph Derbue, Paine Judge.
Thos. Wardlaw Taylor, Paine Judge, Winnipeg.
Albert Clements Killam, " " "

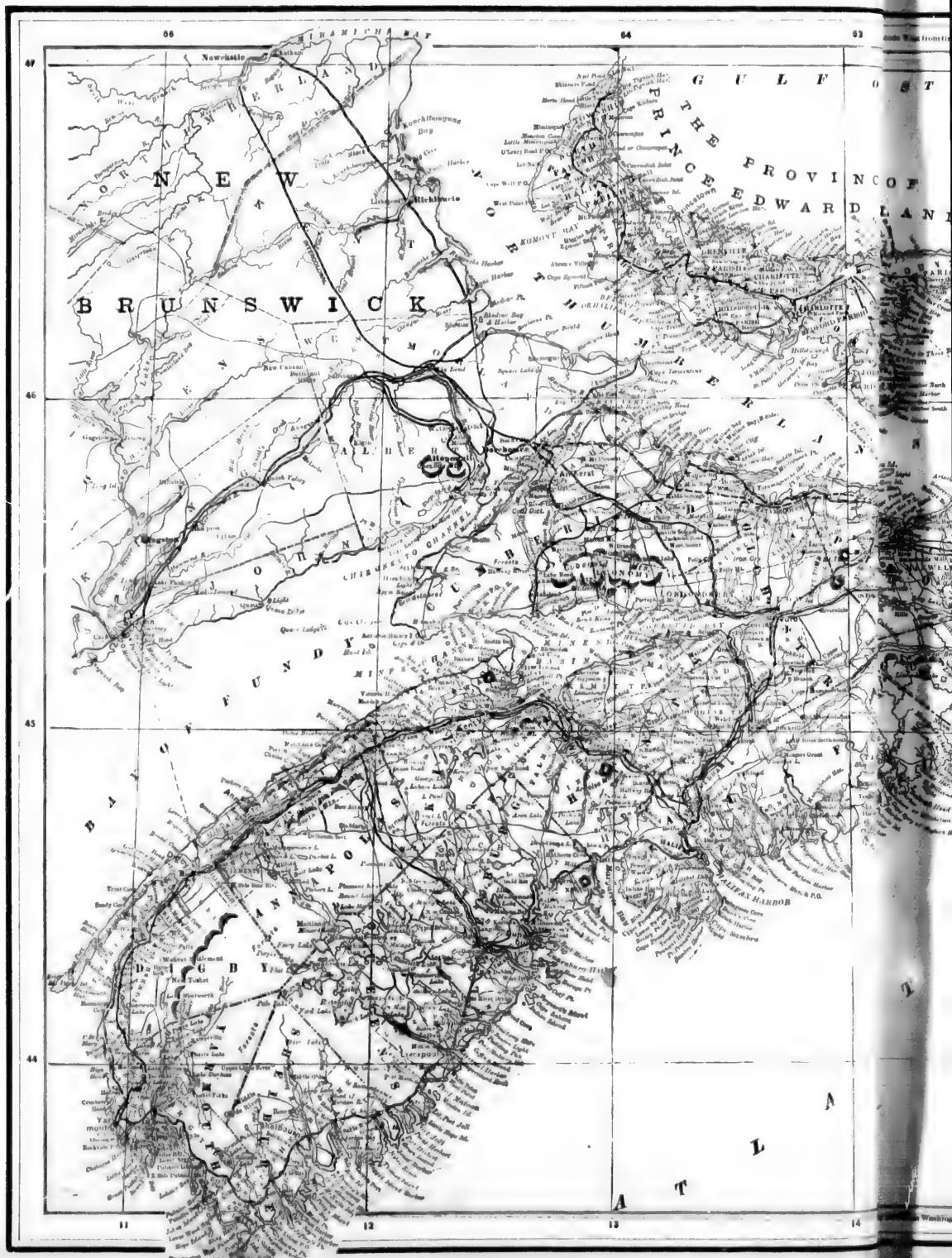
COUNTY COURT JUDGES.

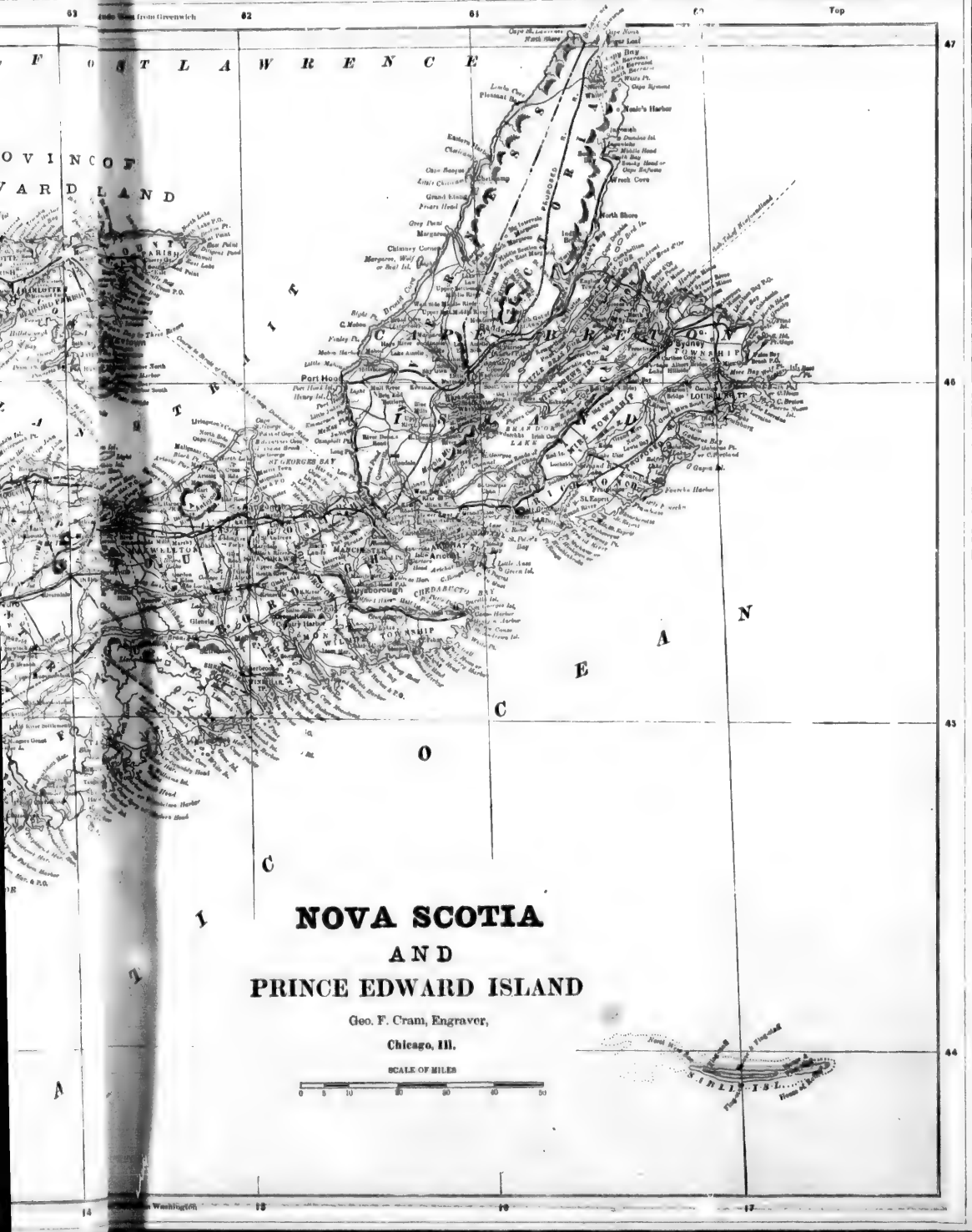
DISTRICTS.	PLACE.
David Muir Walker.....	Western.. Brandon.
Joseph Ryan.....	Central.. Portage la Prairie
Wm. Davis Arlugh.....	Eastern.. Winnipeg.
Louis Arthur Prudhomme.....	Central Div. / Eastern Div. / St. Boniface.

North-West Territory.

SUPREME COURT.

Hons. Hugh Richardson, Justice Western Judicial District of Assiniboia; residence, Regina;
Jas. Farquharson Macleod, Justice Judicial District of Southern Alberta; residence, Fort Macleod;
Charles B. Rouleau, Justice Judicial District of Northern Alberta; residence, Calgary;
Edward Ludlow Wetmore, Justice Eastern Judicial District of Assiniboia; residence, Moosemin;
Thos. H. McGuire, Justice Judicial District of Saskatchewan; residence, Prince Albert.





SUMMARY OF THE COLLECTION LAWS.

Ontario.

ARREST.—A *Capias ad Res*, will be issued out of a Superior or County Court on affidavits showing a cause of action or damages for \$100 or upwards, and that defendant is about to abscond, etc. A *Cap ad Sat*, issues after judgment without judge's order, if proceedings had been instituted by *Ca. Re.*; otherwise must issue on similar grounds. If judgment debtor refuses to be examined as to assets, or on examination discloses fraudulent disposition of property, he may be imprisoned one year.

ATTACHMENTS.—Issues from Division Court on claims for debt or damages from \$4 to \$200, or where debtor absconds from Ontario, leaving personal property, liable to execution, or attempts to remove same from one County to another, or keeps concealed to avoid service of process, with intent to defraud. In Superior or County Affidavits of creditor and to other credible persons required, showing that defendant absconded with intent to defraud.

BILLS AND NOTES.—Notices of protest or dishonor are sufficiently given if addressed to parties liable, at place where instrument is dated, though not their place of residence, unless another place is designated under signature.

BILLS OF SALE AND CHATTEL MORTGAGES.—Sales and mortgages of personally unaccompanied by an actual, immediate and continued change of possession, are void against creditors of vendor or mortgagor, and subsequent purchasers or mortgagees in good faith for value, unless the written instrument of sale or mortgage, or a true copy thereof, be filed with the County Court Clerk of the County where vendor or mortgagor resides; or if not resident, then where the goods were at time of contract, accompanied with affidavit of vendor or mortgagee showing good faith of transaction. And such mortgage must be renewed within one year from date of filing, otherwise it will cease to be valid as against creditors of the mortgagor, and against subsequent purchasers and mortgagees in good faith for valuable consideration.

EVIDENCE.—All parties can testify. An affirmation can be taken if oath is objected to. No exception made as to husband and wife (except in criminal cases); but in suits by or against personal representatives, of the evidence of either party as to matters occurring prior to death of party represented, must be corroborated by other material evidence.

EXECUTION. Issues on judgment by default after eight days from last day for appearance of writ, in case of debt, or otherwise the amount must be assessed by the Court. In jury cases judgment on verdict cannot be entered in the Superior Courts until the fifth day of ensuing term; in the County Court, may be entered on third day of term; provided no motion for new trial has been made, and execution may issue forthwith on entry of judgment. In non-jury cases execution can issue after judgment, unless a judge certifies to stay execution until term. In Division Court, execution usually issues on the expiry of seven days after hearing. In all cases, however after verdict, Court may grant immediate execution on fraud being shown on part of defendant or danger to plaintiff's claim. Execution may issue, (except in the Division Court, where the remedy on all claims under \$40 is against goods only, over that amount a transcript can be issued to the County Court, and execution against lands issued thereon), concurrently against goods and lands of debtor. Since the repeal of the Insolvency Law of the Dominion Parliament (session of 1880), the Ontario Legislature passed an Act to abolish priority amongst execution creditors, whereby all creditors obtaining executions against a debtor within a certain time are entitled to rank *pro rata* upon the estate of such debtor. The Legisla-

ture has also passed an act (1885) respecting assignments for the benefit of creditors, which is equivalent to an Insolvency Act.

EXEMPTION.—The bed, bedding and bedsteads (including a cradle) in ordinary use, necessary and ordinary wearing apparel of debtor and his family, cooking-stove and pipes, other heating-stove pipes, one crane and its appendages, one pair of saw one set cooking utensils, one pair of tongs and sh. one coal scuttle, one lamp, one table, six chairs, one wash-stand and furnishings, six towels, one looking-glass, one hair brush, one comb, one bureau, one clothes press, one clock, one carpet, one cupboard, one broom, twelve knives and forks, twelve plates, twelve teacups and saucers, one wash tub, one sugar basin, one milk jug, one teapot, twelve spoons, two pails, one scrubbing brush, one blacking brush, one wash-board, three smoothing irons, all spinning wheels and weaving looms in domestic use, one sewing machine and attachments in domestic use, thirty volumes of books, one axe, one saw, one gun, six traps, and such fishing nets and seines as are in common use. The articles in this subdivision enumerated not exceeding in value the sum of \$150. All necessary fuel, meat, fish, flour and vegetables, actually provided for family use, not more than sufficient for ordinary consumption of the debtor and his family for thirty days, and not exceeding in value the sum of \$40; one cow, six sheep, four hogs, and twelve hens, in all not exceeding the value of \$75, and food therefor for thirty days, and one dog; tools and implements of or chattels, ordinarily used in the debtors occupation, to the value of \$100, in lieu thereof, the debtor may elect to receive this amount in cash from the proceeds of such sale. Bees reared and kept in hives to the extent of fifteen hives.

GARNISHMENT OF DEBTS.—In Division Court plaintiff may (except in suit for damages) garnish debts due or accruing due to the defendant at commencement of suit, or at any time after judgment entered; and judgment debtor may be ordered to pay certain sums monthly in satisfaction of judgment. In Superior and County Courts orders to garnish debt are granted after judgment obtained. Debts due mechanics, workmen, servants or employees, in respect of wages, if under \$25, are exempt from garnishment; if in excess of \$25, only such excess can be garnished, unless the debt was contracted previous to the 1st of October, 1874, in which case the conditional exemption does not apply.

HOPESTADES.—In the free-grant districts 200 acres may be granted by the Crown to actual settlers over 18 years old, which grants are absolutely exempt from seizure before issue of patent. After issue, as long as any interest in the land is owned by settler, his widow or heirs, it is exempt from twenty years from date of location, unless for debt secured by a valid mortgage, made subsequent to such issue.

INTEREST.—Parties may agree as to rate. Banks and Insurance companies are limited in recovering certain rates of interest, but may receive in advance any rate agreed upon. In absence of agreement the legal rate is six per cent.

LIEN.—Judgment is not a lien, but creditor, upon depositing with the sheriff writs of *fi. fa.* against defendant's goods and lands, binds such property from delivery. These writs may issue simultaneously, but debt must be levied against the goods before proceeding on the lands. Mechanics, contractors, or parties supplying work, machinery or material for the erection, repairing or altering of any building, erection or mine, shall have a "Mechanic's Lien" thereon until the claim for such work or service is paid, which, to be valid, must be registered at the County Registry Office within thirty days; and every such lien attaches to the estate, legal and equitable, of the owner of such building, erection or mine, as the case may be.

LIMITATION.—On simple contracts, debts, and money demands, six years. On contracts under seal, ten years. No distinction made as to non-resident plaintiff. Part-

ies of principal or payment of interest will prohibit from being barred, and any acknowledgment of the debt, or promise in writing to pay, will have the like effect. The acknowledgment, however, must be such as will justify the inference of a promise to pay, and such acknowledgment promise must be signed by the debtor or his authorized agent.

MARRIED WOMEN.—Real and personal estate exempt from husband's debts. His possession of wife's personality does not render the same liable for his debts. A married woman may purchase stocks, deposit money in banks in her own name, give receipts therefor, sue for, and be sued on account of her own property in her own name, and really on business, as if she were *femme sole*. Husband is not liable for debts of wife, regarding her separate employment.

NOTARY.—Appointed by Lieut.-Governor. He draws, passes, and issues deeds, contracts, etc., and attests all commercial instruments for public protestation. All foreign bills and notes must be attested by a notary. Inland bills and notes do not necessarily require protest, yet protest is always advisable, as the presentation of the protest is *prima facie* evidence of allegations therein contained.

SECURITY FOR COSTS.—A non-resident plaintiff must give security for costs of suit if application therefor be made by the defendant, unless such plaintiff has sufficient assets within the Province available to satisfy such costs.

Quebec.

ARREST.—For fraudulent departure from Canada, or secretion of property, past or intended, with intent to defraud. No arrest for debt under \$50. No arrest for foreign debt. England held to be a foreign country.

ATTACHMENT.—Can issue for any debt over \$5 on the same grounds as arrest for debts over \$40.

ATTORNEY.—Has no legal power, without special consent, to receive money and discharge debtor. If moneys be not paid over, his receipt is no bar to execution to collect, unless such special consent be given him by creditor.

ASSIGNEES in Insolvency are subject to the summary jurisdiction of the Court. They are appointed by the Governor, and enter security for each insolvent estate.

COURTS.—(1.) *Circuit Court.*—Jurisdiction up to \$200; cases over \$100 appealable. In the Cities of Quebec and Montreal, cases over \$100 are cases in the Superior Court. (2.) *Superior Court.*—Original jurisdiction over all cases and complaints not cognizable by the Circuit Court, except those of purely Admiralty jurisdiction. (3.) *Court of Review.*—An intermediate appeal, by rehearing, before three Judges of the Superior Court, from the decisions of one Judge of the same Court, of appealable cases from Circuit Court. Deposit required for costs, from Circuit Court, \$20; from Superior Court, \$40. (4.) *Court of Queen's Bench.* is composed of five Judges, and was formerly the final Court of Appeal, except in cases of \$500 sterling and upwards, which might be further appealed to Her Majesty's Privy Council. By the late establishment of (5.) *The Supreme Court* at Ottawa, that is now the final Court of Appeal in this Province, except in certain specified cases, which are still appealable to the Privy Council in England.

Costs of every kind are taxable by tariff duly revised by the authorities.

EVIDENCE.—The rules of the commercial laws of England, as they existed when the statute introducing them was passed.

EXECUTION issues fifteen days after judgment. It may issue at once, upon affidavit showing intended fraud or removal.

DOMINION OF CANADA.

EXEMPTION.—Six of the usual articles used in the debtor's household, together with clothing, bed and bedding of his family. Also, fuel and food for his family for thirty days; one cow, four sheep, two pigs, fifteen hives of bees, and all tools ordinarily used in his trade.

INTEREST.—Legal rate, where no special agreement is made, six per cent.; any stipulated amount can be collected; on accounts, it accrues only from date of suit; on notes, from maturity. Banks are limited to certain rates.

LIMITATION.—Five years from date of maturity, for notes and bills; also, for professional services, disbursements and sales of moveable effects; two years for work labour, wages of workmen (not domestics), damages for offences, or quasi offences in commercial cases, tuition and lodging; one year for hotel or boarding-house charges, libel, etc.

NON-RESIDENTS.—Any non-resident must enter security for costs by two sureties; or a money deposit—in the Circuit Court, \$500; in the Superior Court, \$100; also, there must be filed a Power of Attorney to the advocates to sue.

NOTARY PUBLIC.—Draws and signs deeds, of which certified copies make authentic evidence—he retaining the originals. Upon his death, his heirs-at-law are bound to deposit them in Court, where copies or extracts may be obtained.

STAY OF EXECUTION.—On deposit of costs, as above, execution may be stayed eight days for *Review*; and after final judgment in *Review*, one year, to appeal from such final judgment.

New Brunswick.

ARREST.—In Supreme Court and County Courts arrest may be made on affidavit of cause of action for \$20 or over, but when the cause of action is simply a *claim*, a Judge's order must be obtained. The debtor may at any time apply for examination, and if he has no property, claim his discharge. Unmarried women may also be arrested as above, in above Courts, but no female can be arrested in any other Court. Arrest for debt can be effected in the City Court of St. John, and Portland Civil Court, on affidavit of debt to the extent of \$80. Defendant may also be arrested on entering of judgment, and held for fifty days, with above exception as to no property.

ATTACHMENT.—All real and personal property liable to execution may be attached, under certain conditions and held as security to satisfy anticipated judgments in pending suits.

BILLS AND NOTES.—Three days' grace allowed. Acceptances must be in writing. All parties (to be held) must be notified the same or following day, of the dishonor of a bill or note, by mail or personal service.

EXECUTIONS.—Final judgment may be signed and execution issued twenty days after verdict. When no appearance is entered to a writ, judgment may be signed and execution issue in forty days for ordinary debt, and thirty, in case of a note or bill of exchange. The above refers to Supreme Court. In County Courts, the time for signing judgment and issuing execution is reduced by ten days in each case.

EXEMPTIONS.—The tools, implements, and instruments of debtor's trade, occupation, or profession, together with bedding, furniture, household utensils, clothing, etc., in actual necessary use by his family; also food and a few other articles similar to those exempt in the other Provinces.

GARNISHEE.—Twenty dollars for wages, etc., is exempt from garnishee. With that exception, any amount due defendant from a third party may be attached by garnishee, subsequent to judgment being signed, or even previous thereto, if suit is instituted.

INTEREST.—Legal rate, six per cent. Any rate is allowable by special agreement.

LIMITATION.—For all debts and claims for the same, six years. A payment on account revives claim. Any renewal, without such payment, must be made in writing.

MORTGAGES.—Chattel mortgages are not valid as against creditor of mortgagors, or subsequent innocent purchasers, unless file in County Registrar's office. Mortgages on real estate must be duly signed, sealed, delivered in presence of witness, and registered with County Registrar. Recovery can be made on bonds or covenants therein, either by ordinary action-at-law, foreclosure, or sale.

MARRIED WOMEN.—All property, real or personal of a married woman shall remain absolutely vested in her, and not be liable for her husband's debts, provided, it has not been received from her husband *since their marriage*, the husband however being obliged to join the wife in any conveyance of the same, as the wife joins the husband in bar of dower. Any woman deserted or abandoned by her husband has the same rights as if she were unmarried.

REPLEVIN.—Bonds must be given for twice the value of articles in dispute, pending decision of court as to real ownership.

STATUTE OF FRAUDS.—No person shall be chargeable with the debt, default, or miscarriage of another, even on a special promise to answer for the same, unless such promise shall have been made in writing and signed by the party so promising, or by some one on his behalf, duly authorized so to do.

WILLS, &c.—Wills require two witnesses—deeds, and mortgages, one. In the case of wills, they must sign at request of testator, and in his presence, as well as in the presence of each other—all of which *must be stated* above their signatures, to make the document valid.

Nova Scotia.

ARREST.—Actions on arrest lie in Magistrates Courts, in debt only, and no female can be arrested in this Court. The debt must be at least \$4, and plaintiff must make affidavit that he verily believes defendant is about to leave the Province, and that unless a *capias* be issued the debt will be lost. In the County Court a *capias* can be similarly obtained on any debt between \$20 and \$400; and in the Supreme Court any sum over \$80. Prisoners, confined under the "Insolvent Debtors' Act," may be released on making a formal assignment to judgment creditor of all his property except the usual exemptions.

ATTACHMENT.—If a debtor has left the Province and the debt amounts to \$20 or upwards, a Writ of Attachment may be issued against his goods and lands; and where a creditor has reason to believe that any person is a trustee for such debtor, having property of said debtor in his possession or control, such supposed trustee may be summoned and examined, the trust funds, if any, being bound from date of service of such summons.

CHattel MORTGAGES.—May be given in the first instance to secure *bona fide* debt, but may be made to include any future advances; and are not valid against judgment creditors of mortgagor, or innocent purchasers, for value, unless registered with the Registrar of Deeds for County or District.

COURTS.—One Magistrate has jurisdiction, *in debt*, up to \$20; two, to \$80; the Stipendiary having same as two ordinary magistrates. County Court has jurisdiction in matter of debt, from \$20 to \$400 and the Supreme Court from \$80 upwards. Non-residents may be obliged to give security for costs in either of the latter courts.

EXECUTION may issue immediately on entering judgment being entered, and may be renewed at any time within six years. Lands cannot be sold till judgment has been recorded (twelve months), and the land advertised thirty days in the official *Gazette*, and twenty days by hand-bills.

EXEMPTIONS.—These are practically the same as in the foregoing Provinces including tool and implements of trade or profession, wearing apparel, bedding, household utensils, of self and family, cow, etc., etc.

GARNISHEE.—This process can only be accomplished in Supreme or County Court, and then not in the case of absconding debtors.

INTEREST.—Legal rate, six per cent. Seven is allowable by special contract, when the security is real estate, and ten where it is personal property.

JUDGMENT.—A certificate of judgment may be obtained from the clerk or prothonotary of any Court wherein entered, and such certificate being recorded with the Registrar of Deeds where debtor owns land, binds the said land for twenty years from date of registry, and ranks as a mortgage.

LIMITATION.—On ordinary contracts, and arrears of dower, rent, or interest, six years from date of cause of action. Money secured by mortgage, judgment or lien upon lands or rent thereof, twenty years. Debtor must be within jurisdiction of Court when time commences to count. Payment on account of either principal or interest, or a promise in writing to renew the same, constitutes a renewal.

MARRIED WOMEN.—May own real estate, but cannot convey the same without consent of husband. All personal property owned by her previous to or acquired since marriage, becomes the absolute property of husband, unless in trust for her sole benefit.

REPLEVIN—In case of goods or chattels wrongfully seized or detained, an action in Replevin lies, to which may also be added an action for damages. Action in Replevin must be instituted by affidavit of right of possession or ownership, and accompanied by a bond of double the value of the goods in dispute, as a guarantee for costs.



COUNTY AND JUDICIAL OFFICERS—ONTARIO

When the officers' Post Office Address is not given it is that of the County Town

[illegible]

Post Office Addresses—1 York, 2 Dunnville, 4 Cuckstown, 5 Galt, 6 Fergus, 9 Bath.

*And Deputy Registrar in Chancery

†Deputy Clerk of the Crown and

NAME.	District or County.	Residence.	NAME.	District or County.	Residence.
Wm. Harbert.	Bruce.	Wakarusa.	Frederic Davis.	Middleton.	Lemmon
Robert Lyon.	Warren.	Okawa.	Thomas M. Jensen.	Northwestern and Burhan.	Peter Hope
Edmund J. Lutz.	Lincoln.	Over Sound.	Geo. B. Bartel.	Lincoln.	Shibby.
Edwin H. Fisher.	Harrison.	Belleville.	Wm. E. A. Boj.	Lincoln.	Barre
Bernard L. Hoyle.	Harrison.	Indefat.	Edith R. Carmack.	Sturgeon, Dan. and Cicouary.	Cornwall
Robert S. Woods.	Keokuk.	Chadron.	A. Lavonne.	Wabasha.	Berlin
J. A. Mackenzie.	Lincoln.	Sarina.	A. C. Chudick.	Wellington.	Utah
		Edmond, Montana.			

Adelington	H. Wilkinson	Hastings, East and M	E. B. Fradette	Peel	A. P. Reed
Algoma, West	Norm. W. McLean	Huron, West and East	R. L. Dwyer	Peterborough, W. & E.	Chas. A. Wellen
Arnprior	J. M. Hamilton	Huron, South	Isaac F. Timm	Prescott	Peter O'Brien
Bancroft	Ed. Chatham	Kent	W. S. Wolfe	Richmond	John J. Jellison
Barry's Bay	A. J. Jones	King	W. H. Williams	Robtfrw, North	John Deane
Bassettville	H. H. Alexander	Lanark, W. & E.	W. H. Williams	St. Catharines	M. O'Brien
Baxter	W. H. Barrett	Lanark, North	W. H. Williams	Simcoe	J. Danjani
Berlin, West and East	J. J. Kingzett	Lanark, South	W. S. Scarle	Simcoe, S. & B.	W. F. A. Taylor
Carleton	J. A. McArthur	Leeds and Terrapitt, North, and Leeds South	H. B. Macdonald	Toronto, W. & C.	J. E. Macdonald
Chaplin, Huron, and Huron and Terrapitt	W. M. Grogan	Leeds and Terrapitt, North and South	J. H. Fraser	Victoria, N. & B.	A. Hingst
Durham, East and West	T. M. Benson	London	J. H. Fraser	Victoria, N. & B.	A. Hingst
Elgin, East and West	D. J. Hughes	Midland, E. & W.	W. H. Fraser	Victoria, South	W. H. Benson
Elgin, North and South	E. B. Horn	Midland, North	H. C. Lipp	Waterloo, North	L. Benson
Frontenac	H. H. Alexander	Moncton	H. C. Lipp	Waterloo, South	L. Benson
Georgetown	H. H. Alexander	Norfolk, E. & W.	B. T. Livingston	Wellington, N. & B.	A. Hingst
Grey, North and East	H. H. Alexander	Norfolk, North, E. & W.	G. S. Clark	Wellington, Centre	A. C. Hingst
Grey, North	H. H. Alexander	Norfolk, South	G. S. Clark	Wellington, South	A. C. Hingst
Hastings	M. C. Upper	Ontario, E. & W.	S. F. Burman	York, North and East	H. Morgan
Hastings	T. A. Miller	Oxford, North and South	H. G. Lipp	York, West	John Hingst

[illegible]

DOMINION OF CANADA.

STIPENDIARY MAGISTRATES IN ONTARIO.

<i>Albion</i>	<i>Albion</i>	<i>Albion</i>	<i>Albion</i>	<i>Albion</i>
<i>Albion</i>	<i>Albion</i>	<i>Albion</i>	<i>Albion</i>	<i>Albion</i>

REGISTRARS OF DEEDS, ONTARIO.

Inspector of Registry Office, Sidney Smith, Ontario.

COUNTIES, ETC.	REGISTRARS.	COUNTIES, ETC.	REGISTRARS.	COUNTIES, ETC.	REGISTRARS.
ALBION DISTRICT.....	J. Hamilton, 1001 St. Mary	KEELE.....	P. D. McKellar, Chatham.	PERKINS.....	D. D. Hay, Stratford.
ALBION DISTRICT.....	J. Hamilton, 1001 St. Mary	KEELE.....	P. D. McKellar, Chatham.	PERKINS.....	D. D. Hay, Stratford.

REGISTRATION DIVISIONS, ONTARIO.

DURHAM.....	East Riding-Townships of Hope, Owen and Maryborough.	MIDDLESEX.....	East and North Riding Townships of London, West	WELLINGTON.....	North Riding Townships of Arthar, West Lister
DURHAM.....	East Riding-Townships of Hope, Owen and Maryborough.	MIDDLESEX.....	East and North Riding Townships of London, West	WELLINGTON.....	North Riding Townships of Arthar, West Lister

COUNTIES AND REGISTRARS, MANITOBA.

HON. JAMES A. MILLER, Registrar-General, Land Title Office. R. M. HOWARD, Inspector of Public Offices, Winnipeg.

Beautiful Plains, William Currie, Neepawa, Brandon and Brandon	Ann, Manchester, W. H. Nash, Emerson, Marquette, John G. Fairbanks,	Winnipeg, C. A. Boulton, Brillon, Kellick, George Han, St. Boniface;
Beautiful Plains, William Currie, Neepawa, Brandon and Brandon	Ann, Manchester, W. H. Nash, Emerson, Marquette, John G. Fairbanks,	Winnipeg, C. A. Boulton, Brillon, Kellick, George Han, St. Boniface;

REGISTRATION DISTRICTS, N. W. T.

General Registrar, W. L. Scott, Battleford.

THIRTEEN.....	Boundaries of the East and West same as Township, and extending from Townships 11 to 24, inclusive. Registrar, George A. Montgomerie, Regina.	THIRTEEN.....	Boundaries of the East and West same as Township, and extending from Townships 11 to 24, inclusive. Registrar, George A. Montgomerie, Regina.
THIRTEEN.....	Boundaries of the East and West same as Township, and extending from Townships 11 to 24, inclusive. Registrar, George A. Montgomerie, Regina.	THIRTEEN.....	Boundaries of the East and West same as Township, and extending from Townships 11 to 24, inclusive. Registrar, George A. Montgomerie, Regina.

DIVISION COURT CLERKS, ONTARIO.

DIVISION COURT INSPECTOR, JOSEPH DICKY, PARLIAMENT BUILDING, TORONTO.

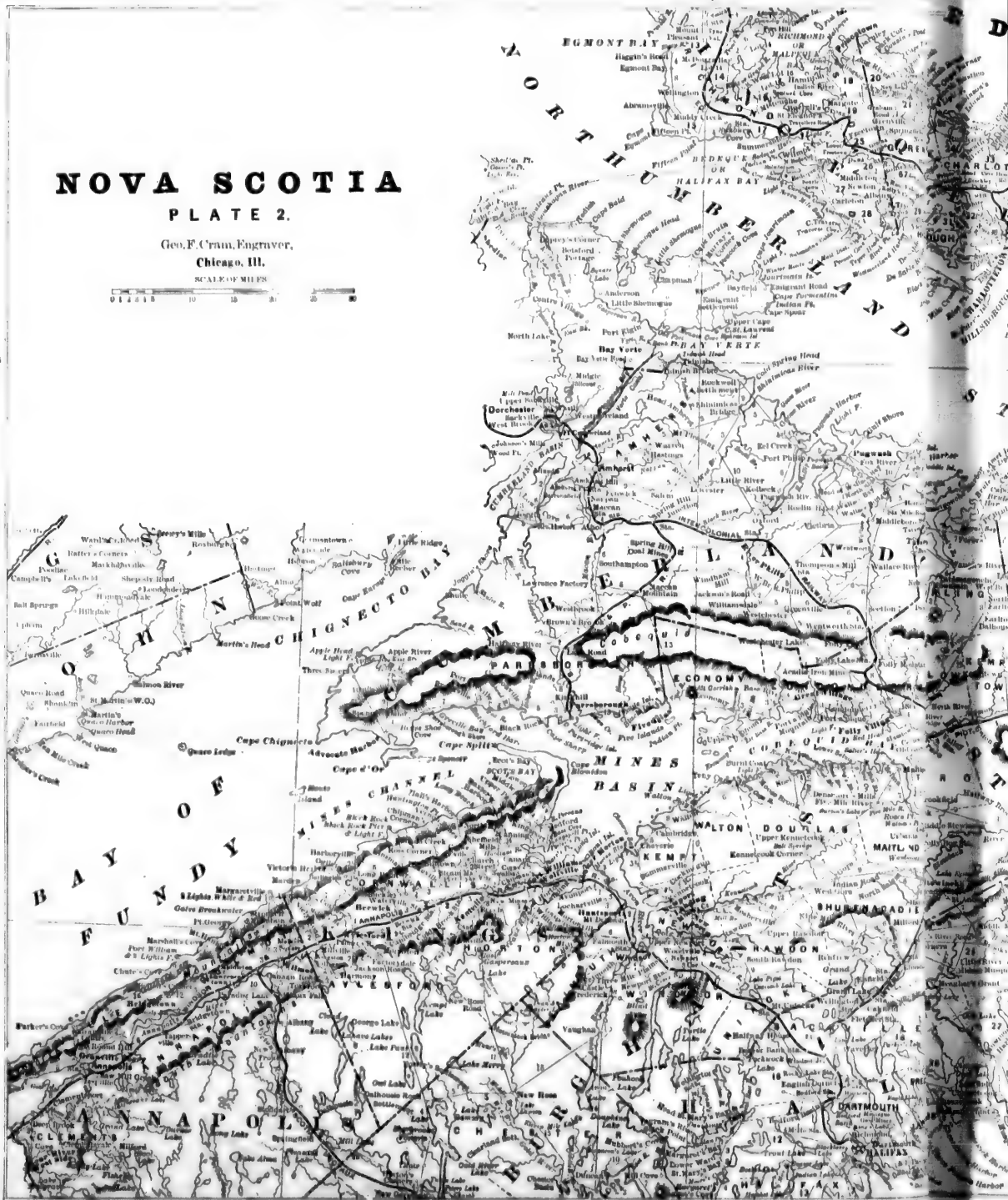
ALBION DISTRICT.	ALBION DISTRICT.	ALBION DISTRICT.	ALBION DISTRICT.	ALBION DISTRICT.	ALBION DISTRICT.
I. Edward Higgins.....	Sault Ste. Marie	I. J. A. Stewart.....	Sault Ste. Marie	I. J. A. Stewart.....	Sault Ste. Marie
I. Edward Higgins.....	Sault Ste. Marie	I. J. A. Stewart.....	Sault Ste. Marie	I. J. A. Stewart.....	Sault Ste. Marie

NOVA SCOTIA

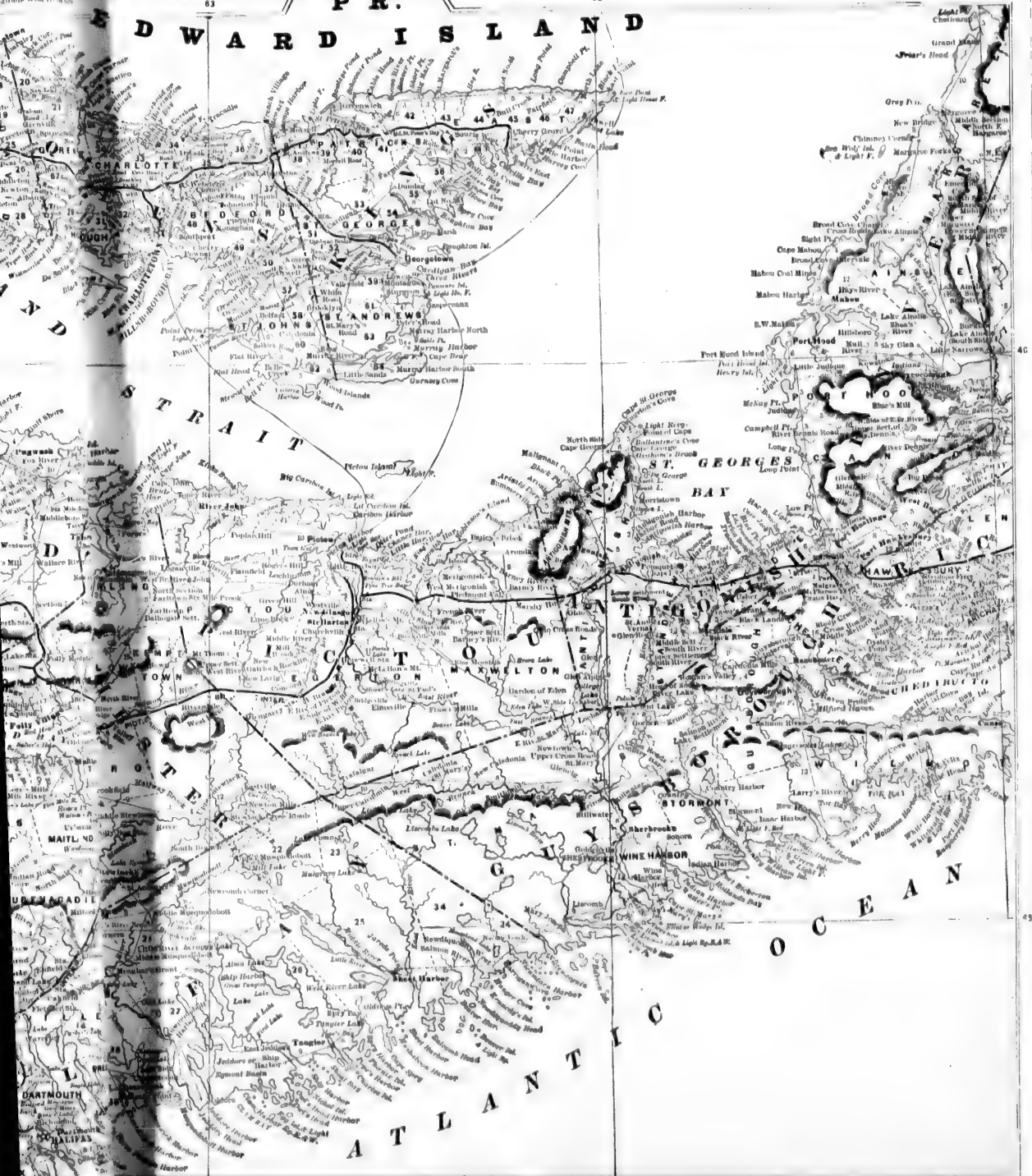
PLATE 2.

Geo. F. Cram, Engraver,
Chicago, Ill.

SCALE OF MILES



EDWARD ISLAND



DOMINION OF CANADA.

RIPMINGTON DISTRICT.			BREWSTER.			WATFORD.		
I. J. D. Cuthbert	Stratton Falls	IV. James Sharpe.	Dart's Falls	I. W. C. Irving	Pembroke	I. A. J. Peterson	Berlin	
II. John McMeekin	Matawa	V. H. B. Shaw	MacIntosh	II. H. F. Nelson	Bensburgh	II. Otto Koda	Fresno	
III. J. G. Gormack	North Bay	VI. H. M. Gormack	MacIntosh	III. H. F. Nelson	Amnapur	III. Wm. H. Wason	Asy	
NORFOLK.			PERL.			WALLINGFORD.		
I. W. R. Griffin	Almeida	I. J. W. Main	Brantford	I. A. J. Clond	Barrie	I. G. L. Hudson	Welland	
II. Robert Mathews	Watersford	II. T. K. Beatty	Stratville	II. H. Manning	Bradford	II. J. Wilson	Marquette	
III. Robert Grey	Windsor	III. J. W. Main	Stratville	III. H. Manning	Bradford	III. A. Orchard	Niagara Falls	
IV. C. S. Harris	Coventry	IV. F. Long	Stratville	IV. R. C. Campbell	Collegedale	IV. A. R. Schiffo	Port Colborne	
V. M. McAll	Victoria	V. George Irving	Stratville	V. J. P. Henderson	Orillia	V. A. Baker	Wellington	
VI. R. C. Maher	Port Dover	VI. W. J. Hay	Stratville	VI. J. G. Hood	Orillia	VI. A. H. H. H.	Wellington	
VII. Lawrence Skye	Port Dover	PETERBOROUGH.			VII. J. P. Henderson	Orillia	VII. A. Baker	
NORTH-WINDWARD AND DERNIA.			PETERBOROUGH.			WINDWARD.		
I. Fred Abbott	Bornhamville	I. R. W. F. F.	Newcastle	I. A. J. Clond	Barrie	I. G. L. Hudson	Welland	
II. Samuel Wind	Newcastle	II. Thomas Fraser	Newcastle	II. H. Manning	Bradford	II. J. Wilson	Marquette	
III. George M. Furb	Port Hope	III. Thomas Campbell	Newcastle	III. H. Manning	Bradford	III. A. Orchard	Niagara Falls	
IV. J. D. Cuthbert	Port Hope	IV. Thomas Campbell	Newcastle	IV. R. C. Campbell	Collegedale	IV. A. R. Schiffo	Port Colborne	
V. A. B. Howell	Coburn	V. J. D. Booth	Applie	V. J. P. Henderson	Orillia	V. A. Baker	Wellington	
VI. Henry Lawton	Orillia	PRESCOTT AND RUSSELL.			VI. J. G. Hood	Orillia	VI. A. H. H. H.	
VII. H. D. D.	Orillia	I. David D. D.	Orillia	VII. J. P. Henderson	Orillia	VII. A. Baker	Wellington	
VIII. M. P. K.	Orillia	II. William Shible	Vancouver Hill	VII. J. P. Henderson	Orillia	VII. A. Baker	Wellington	
IX. T. T. T.	Orillia	III. William Shible	Vancouver Hill	VII. J. P. Henderson	Orillia	VII. A. Baker	Wellington	
X. Daniel Kennedy	Campbellford	IV. Thomas Fraser	Newcastle	VII. J. P. Henderson	Orillia	VII. A. Baker	Wellington	
ONTARIO.			PRESCOTT AND RUSSELL.			WINDWARD.		
I. D. C. Macdonell	Whitby	I. David D. D.	Orillia	I. A. J. Clond	Barrie	I. G. L. Hudson	Welland	
II. M. G. G.	Greenwood	II. William Shible	Vancouver Hill	II. H. Manning	Bradford	II. J. Wilson	Marquette	
III. John H. H.	Port Hope	III. Thomas Fraser	Newcastle	III. H. Manning	Bradford	III. A. Orchard	Niagara Falls	
IV. Z. Z. Z.	Whitby	IV. Thomas Fraser	Newcastle	IV. R. C. Campbell	Collegedale	IV. A. R. Schiffo	Port Colborne	
V. George F. Bruce	Beaverton	V. J. D. Booth	Applie	V. J. P. Henderson	Orillia	V. A. Baker	Wellington	
VII. F. G. G.	Upernivik	VI. W. J. Hay	Stratville	VI. J. G. Hood	Orillia	VI. A. H. H. H.	Wellington	
SHEPHERD.			PETERBOROUGH.			WINDWARD.		
I. F. W. MacQueen	Woodstock	I. Robert Boyle	Peterborough	I. A. J. Clond	Barrie	I. G. L. Hudson	Welland	
II. M. F. Ainsley	Brantford	II. W. C. D. Long	Wellington	II. H. Manning	Bradford	II. J. Wilson	Marquette	
III. J. B. Ainsley	Brantford	III. J. B. Ainsley	Wellington	III. H. Manning	Bradford	III. A. Orchard	Niagara Falls	
IV. James Barr	Norwich	IV. A. B. Ainsley	Wellington	IV. R. C. Campbell	Collegedale	IV. A. R. Schiffo	Port Colborne	
V. James Street	Thornhill	V. A. B. Ainsley	Wellington	V. J. P. Henderson	Orillia	V. A. Baker	Wellington	
VI. John H. H.	Thornhill	VI. B. E. Harrison	Wapoose	VI. J. G. Hood	Orillia	VI. A. H. H. H.	Wellington	
PARIS AND DISTRICT.			PRINCE EDWARD.			WINDWARD.		
I. B. H. Stewart	Paris Sound	I. Robert Boyle	Peterborough	I. A. J. Clond	Barrie	I. G. L. Hudson	Welland	
II. A. H. Armstrong	McKillop Bay	II. W. C. D. Long	Wellington	II. H. Manning	Bradford	II. J. Wilson	Marquette	
III. B. H. Stewart	McKillop Bay	III. J. B. Ainsley	Wellington	III. H. Manning	Bradford	III. A. Orchard	Niagara Falls	
PRINCE EDWARD.			PRINCE EDWARD.			WINDWARD.		
I. B. H. Stewart	Paris Sound	I. Robert Boyle	Peterborough	I. A. J. Clond	Barrie	I. G. L. Hudson	Welland	
II. A. H. Armstrong	McKillop Bay	II. W. C. D. Long	Wellington	II. H. Manning	Bradford	II. J. Wilson	Marquette	
III. B. H. Stewart	McKillop Bay	III. J. B. Ainsley	Wellington	III. H. Manning	Bradford	III. A. Orchard	Niagara Falls	
PRINCE EDWARD.			PRINCE EDWARD.					

LIST OF BARRISTERS, ATTORNEYS, ETC., DOMINION OF CANADA.

Alcon—County Hallow, Ont.
Johnson & McLean, (Lunenburg, (branch).
Albert—N. W. Territory.
Gunn, W. H.
MacIver, W. W.
Newlands, H. W.
Rifton, A. L.
Albert Hopewell—Albert Co., N. B.
Dickson, Joseph H.
Trueman, C. C. Gleggarty, Ont.
Alexander—
MacIntyre & Smith, (M. Munroe, A. L. Smith).
Tiffney, E. H.
Allison—Co. Simcoe, Ont.
Barnard & Palmer, (C. W. Howard, W. G. Fisher).
Duncan, J. M.
McCarthy, Pepler & McCarthy, Barrie (branch).
Almonce—Co. Lanark, Ont.
Dowdell, R. J.
Fruer, J. R.
Frederick & Irving, (J. Jamieson, A. M. Grog).
Macdonnell & Skinner.
(P. U. Macdonnell, A. Skinner).
Alvinson—Co. Lambton, Ont.
Smyle, A. E.
Amherst—Cumberland Co., N. B.
Fullerton, Wm. M. J.
Hickman, John W.
Hoskins, Wm. J. W. McMill, W. F. Dunkin.
Pipes & McCully. (W. T. Pipes, W. H. McCully).
Rainford, C. E.
Smith, Landon R.
Smith, John J.
Townshend & Hickley.
(C. J. Townshend, C. C. J. Medley Townshend.
(A. H. Hickley).
Amherstburg—Co. Essex, Ont.
Coffey, James M.
Reade, W. H.
Annapolis—Co. Wentworth, Ont.
Leitch, Edward.
Andover—Victoria Co., N. B.
Gaiminger, D. B.
Lawson, Thomas.
Stratton, Alex.
Annapolis Royal—Annapolis Co., N. B.
Leahy, J. F.
Crawling, Edward C.
De Role, William.
Dillon, J. M.
Mills & Mills, (C. B. Mills, H. E. Gillis).
Owen, James M.
Richie & Ritchie, (W. R. Almond Ritchie, Jas. J. Ritchie, P. J.).
Antigonish—Antigonish Co., N. B.
Crawley, J. C.
Henry, R. N.
Macdonald, Daniel.
Macgregory & Chisholm, (Angus Macgregory,
C. P. Chisholm).
Maitland, C. F.
Arichat—Richmond Co., N. B.
Chandler, William B.
Culver, William, H.
Deane, David A.
Miller, Ross, William.
Arnprior—Co. Renfrew, Ont.
Dalmage & Burwash, (R. Dalmage, A. Burwash).
Thompson, J. R.
Arthabaska—District Arthabaska, Quebec.
Barnea, Thomas.
Cannon, L. J.
Chaffault, A. T.
Crepeau & Cote, (L. P. E. Crepeau, C. G., P. H. O.).
Felson, W. H.
Laurier & Lavigne.
(Hod. Wilfred Laurier, C. G. Joe. Lavigne).
Proulx, E. L. C. P.
Toussaint, M. J. A. A.
Dowell, C. J.
Thomson, D. Phil.
Arthur—Co. Wellington, Ont.
Irvine, C. E.
Landy, J. J.
McMurtu, M. M.
Williams, M.
Aurore—Co. York, Ont.
Geddes, W.
Robinson, C. C.
Aylmer—Co. Elgin, Ont.
Crawford & Haines.
(J. Crawford, A. E. Haines).
Aylmer—Victoria Co., N. B.
(E. A. Miller, A. H. Backhouse).
Stevens & Tremblay.
(W. K. Stevens, W. J. Tremblay).
Aylmer—District Ottawa, Quebec.
Ayles, John.
Boyer, Henry.
Brown, Thomas P.
Gunn, J. M.
Kenner, W. H.
Baddeck—Victoria Co., N. B.
Hallington, Alfred E.
McIntosh, John J.
McDonald, John A.
Barris—Co. Town, Co. Simcoe, Ont.
Cotter, J. H.
Dickenson & McWatt.
John Dickenson, D. F. McWatt.
Henson & Crowlley.
(C. E. Henson, A. E. H. Crowlley).
Hearn & Murchison.
(E. H. Hearn, D. C. Murchison).
Leacock, And & Kerr.
R. Lengua, W. Asht, John H. Kerr.
Bathurst—Bathurst & Lonsdale.
(Wm. Lonsdale, C. H. H. Straley, C. C., G. W. Lonsdale).
Lloyd, J. A.
McCarthy, Pepler & McCarthy.
(D. McCarthy, C. C. F. E. Pepler, J. A. McArthur).
Plaxton, C. V.
Reid-Harland, Geo. A.
Stewart, H. D.
Apronte, J. J.
Bathurst—Gloucester Co., N. B.
Hewitt, H. D.
Ther, Joe Brimay, C. T. T. Swayne Des Brimay.
Lauria, Narcisse A.
MacIsaac, D. Gustave.
Bay Verte—Westmorland Co., N. B.
Welling, Thomas.
Beausabers—District Beausabers, Quebec.
Beauchemin, Louis.
Beaus & Laurendeau.
Louis Beaus, Joseph George Laurendeau.
Beaverton—Co. Ontario, Ont.
Jaslett, Frank.
Bedford—Dist. of Bedford, Que.
Butler, H.
Cassidy, John.
Constanation, R.
Cuthbert & Cornhill.
R. A. Crothers, B. A. Bel, R. E. Cornhill.
Bellefleur—Co. Hastings, Ont.
Anderson, P. J. M.
Bell & Bignar.
J. Bell, C. W., W. H. Bignar.
Bull, S. J.
Burnett, S. B., R. L. D.
Clute & Willard.
Clute & Clute, J. Williams.
Diamond, W. J.
Dickson & Hubbs.
Duggan & Stewart.
A. H. Duggan, C. C. D. E. K. Stewart.
Desmarc & Northrup.
(George Desmarc, W. B. Northrup, P. A. Polinger & Masson).
S. B. Faskiner, Stewart Masson.
Ingl & Sherry.
J. J. F. Ingl, G. J. Sherry.
Portin, John A.
Henderson & Henderson.
O. K. Henderson, C. C. F. O. A. Henderson.
Henderson, L. H.
Mansfield, P.
O'Brien, R.
O'Flynn, P. F.
Ponton, W. N.
Porter, E. H.
Robertson & Thomas.
A. Robertson, J. P. Thomas.
Robertson, D. B.
Skinner & Redick.
C. O. Skinner, P. E. Redick.
Blington & Noyes.
J. H. Blington, C. J. Noyes.
Wallbridge & Francis B.
Wallbridge, S. S.
Berlin—Co. Waterloo, Ont.
Andrews, H. M.
Bosley & Bennett.
W. H. Bosley, R. E. P. Clement.
Wardell, Thomas.
King, John.
Miller & Ritzer.
A. Miller, B. Ritzer.
Berthier—Dist. Richelieu, Que.
Alain, Victor.
Chapoyev, C. A.
Chenue, Amador.
Laferrriere, A. A.
Piche, R. C. C. P.
Truchon-Montigny, F. R.
Birtle—Birtle Co., Manitoba.
Hallen, G. R. John.
Meyers, Charles J.
Blenheim—Co. Kent, Ont.
McDonald, R. E.
Bothwell—Co. Kent, Ont.
Hickey, W. W.
Taylor, George E.
Bracebridge—Co. Durham, Ont.
Armour, Robert.
Cuthbert, John, R. M.
Hutchinson, St. H. H.
Brown—County Hallow, Ont.
Lyonville, Robert H.
Rimington, D. B.
Bracebridge—Dist. Muskoka, Ont.
Browning, J. B.
Leint, C. W.
Mahaffy & Mahaffy.
W. C. Mahaffy, A. A. Mahaffy.
Palmer, J. A.
Bradenford—Co. Simcoe, Ont.
Jenkinson, Mark.
Brampton—Co. Peel, Ont.
Beynon & Manning.
J. W. Beynon, C. J., J. J. Manning.)
Murray & McKechnie.
(A. G. Murray, Arch. McKechnie).
Justin, B. F.
Milligan & Pringle.
(T. C. Milligan, R. H. Pringle).
Morphy, T. & J.
T. Morphy, W. R. Morphy.
McFarlane & Graham.
W. H. McFarlane, E. G. Graham.
Stonchew & Blain.
E. Stenhouse, F. J. Blain.
Brandon—Brandon Co., Man.
Only 15 families.
T. M. Blain, G. H. Caldwell.
Her Holmes & Henderson.
H. E. Henderson, F. G. A. Henderson.
Marsden, W. A.
Peterson, A. M.
Hussey & Cooper.
J. Hussey, D. H. Cooper.
Horton, Clifford.
Brantford—Co. Brant, Ont.
Boyd, J. W.
Brooke, Daniel.
Inneswater, W. H.
Harty, Wilkie & Jones.
(Hon. A. A. Harty, C. A. J. Wilkie, C. S. Jones).
Harty & Swales.
James Harty, F. Swales.)
Hayd, Mulrhead & Jones.
J. P. Hayd, G. H. Mulrhead, W. D. Jones.)
MacKenzie, Valerius.
VanNorman, G. B., C. G.
Wade, T. A.
Wilson, H. McK. G. C.
H. McK. Wilson, C. C. Peter Purves.)
Woodford, Thomas.
Bridgetown—Annapolis Co., N. B.
A. Under, Thomas W.
Ingl, J.
Krylin, John.
Bernmann, J. J. G.
Morre, Albert.
Parker, G. O.
Huggins, T. D. & Sons.
(T. D. Huggins, C. C. Edwin Huggins, Harry Huggins).
Bridgewater—Lunenburg Co., N. B.
Bryant, J. W.
Marshall, W. H.
Owen, Hock, W. H., Q. C.
Wade, F. B.
Brighton—Co. Northumberland, Ont.
Falcon, Thomas.
Ironside, J. W.
Trotter, J. C.
Brookville—Co. Town, Ont. Leeds and Grenville, Ont.
Brown, M. M.
Buck, Jacob H.
Duncan, Joseph.

DOMINION OF CANADA.

Braceville—(Contd.)
Fraser & Reynolds.
(Hon. C. F. Fraser, Q. C., R. J. Reynolds.)
Hutchinson & Fraser.
(James A. Hutchinson, A. A. Fraser.)
Jones & Wright.
W. H. Jones, W. J. Wright.
Judd, J. C.
Marshall, F. J.
Sherwood, William
Wood & Webster.
J. F. Wood, G. R. Webster.

Brussels—Co. Huron, Ont.
Dickson, W. B.
Elliot, Clifford
(F. E. Wade, W. M. Sinclair.)

Buckingham—Co. Ottawa, Que.
Hauray, F. A.

Bouchette—Kent Co., N. B.
James, Henry H.

Burlington—Co. Halton, Ont.
Irvine, T. J. C.
Pringle, H. N.

Burk's Falls—Perry Sound, Dis. Ont.
Bolt, William.
King, F. J.

Caledonia—Co. Halton, Ont.
Van Norman, G. B., Q. C., (Bramford Branch)

Calgary—North-West Territory.
Bowen, J. F.
Shewker, Henry
Coutman, J. H.
Ede, T.
Lafferty, T. B.
Loughhead, J. A.

Campbellford—Co. Northumberland, Ont.
Cobbie, A. L.

Campbellton—Dist. Hastings Co., N. B.
McAuliffe, John
Murray, William.

Canning—Kings Co., N. B.
Lamb, Fred C.

Cannington—Co. Ontario, Ont.
Sinclair, A. J.

Carberry—Manitoba.
Black, W. H.

Carleton Place—Co. Lanark, Ont.
Greig, Thomas
Paterson, Robert
Sheppard, D. K.

Cayuga—Haldimand, Ont.
Coutter & Goodman.
C. W. Coutter, A. K. Goodman.
Salder, C. G.
Martin, J. H.

Chapau—Dis. Ottawa, Que.
Graham, Taurer.

Charlottetown—Prince Edward Island.
Dayrell & Blair.
R. S. Bayfield, S. Blanchard.
Davies & Sutherland.
L. H. Davies, G. C. J. M. Sutherland.
Fitzgerald, R. H., Q. C.
Hazard, Francis L.
Hazard, William Douglas.
Hodgson, Edward J., Q. C.
Haviland, Estare H.
McDonald, John N.
McLean, Martin & McDonald.
A. A. McLean, D. C. Martin, Hector C. McDonald.
McLeod, Norman & McQuarrie.
N. McLeod, W. A. G. Morton, N. McQuarrie.
Palmer & Mulhally.
Hedley V. Palmer, James N. Mulhally.
Palmer & McLeod.
Charles Palmer, Q. C., Malcolm McLeod, Q. C., Jas. H. Palmer, D. C. McLeod.
Peterson & Peterson.
F. Peterson, A. Peterson.
Reid, James H.
Reid, Richard
Stewart, William R.
Sullivan & McGill.
W. W. Sullivan, Q. C., Chester B. McNeill.
Warburton & Smallwood.
A. B. Warburton, Chas. H. Smallwood.
Weeks, William A.

Chatham—Co. Kent, Ont.
Atkinson & Christie.
(C. H. Atkinson, Q. C., D. M. Christie, C. R. Bell, Edwin.)
Douglas, Douglas & Walker.
(William Douglas, Q. C., G. B. Douglas, J. A. Walker.)
Jarriss, Sailer M.
Lafferty, A. M.
Martin, W. J.
Moffat, Thos.
O'Neill, C. John.
O'Brien, J. B.
O'Hara, Robert.
Pegley, Charles E.
Wilson, Jackin & McKee.
(M. Wilson, J. G. Jackin, W. R. McKee.)
Scane, Houston, Craddock & Stone.
(R. W. Scane, M. Houston, A. Craddock, Fred Stone.)
Warren, James.
Williamson, J. F.

Chatham—Northumberland Co., N. B.
Bennett, Mich. H. B.
Cassan, Richard.
Davidson, Allan A., Jr.
Fraser, George B.
Lawson, H. A. (Col. Ind. Rev.)
Trevell, Leonard J.
Winkler, Warren C.

Chesley—Co. Bruce, Ont.
Mickle, C. J.

Chicoutimi—Dis. Chicoutimi, Que.
Bélair, L. G.
Gagné, J. A.

Chicoutimi—(Contd.)
Gagnon, Chas.
Pelletier, Joseph.
Savard, F. V.

Clifton—Co. Huron, Ont.
Hart, Charles A.
Manning & Scott.
A. H. Manning, J. Scott.
Powell, F. H.

Constance—Dis. St. Francis, Que.
Bestler, Joseph.
St. Pierre, G. H.

Cobourg—Co. York, Ont.
Dunbar, John H.
Greville, J. Vance.
Hilton, F. A.
Holland, Henry F.
Hosack & Field.
(D. C. Hosack, F. H. Field)

Colborne—Co. York, Ont.
Kerr, John W.
Riddell, W. K.
Smith & Cruickshanks.
Hon. S. Smith, Q. C., J. Y. Cruickshanks.
Wilson, R. W.

Colborne—Co. Northumberland, Ont.
Ketchum, Jay.
Kupper, William L.

Collingwood—Co. Simcoe, Ont.
Bisale, John, Jr.
Molever & Gannon.
G. Molever, C. Gannon.
Robertson, Henry.

Cornwall—Co. York, Ont.
Gibson, John.
Alguire, J. C.
Chapman, John.
Chisholm, William.
Leitch & Pringle.
J. Leitch, H. A. Pringle.
Macdonald & McIntosh.
George S. Macdonald, J. A. McIntosh.
Macintosh, Liddell & Cline.
D. C. Macintosh, Q. C., J. W. Liddell, C. H. Cline.
Smith, H.

Cowanville—Dis. Bedford, Que.
O'Halloran & Duffy.
J. O'Halloran, Q. C., H. T. Duffy.

Dalhousie—Hastings Co., N. B.
Barber, J. A. C.
Bennet, Frank A.
Hartwell, James
Morse, James B.

Danville—Dis. St. Francis, Que.
Joubert, Louis.

Delmarine—Manitoba.
Stuart, F. T.

Digby—Digby Co., N. B.
Copp, Albert J. S.
Monroe, Robert J.
Shew, Thomas C., Q. C.
Vick, John M.
Wade & Wade.
J. C. Wade, Q. C., A. V. Wade.

Dorchester—Westmoreland Co., N. B.
Chandler, Edward B.
Chapman, Allan W.
Chapman, Albert J.
Chapman, W. H.
Emerson, Henry R.
Harrington, Fred & Hewson.
Hon. T. Harrington, H. G. Teed, R. W. Hewson.
Kupper, Charles E.
Landry, Pierre A.
Gaulton, Alfred E.
Peck, Joseph B.
Richard, Ambrose D.
Wells, W. Witherfords.

Drayton—Co. Wellington, Ont.
Jacob & Gordon.
J. Jacob, W. H. Gordon.
Lewis, Alex. S.

Dresden—Co. Kent, Ont.
Bending & Weir.
T. B. Bending, W. Weir.
Sharpe, James W.

Drummondville—Dis. Arthabaska, Que.
Bessing, R. J.
Richard, J. J.
Watts, W. J.

Dundalk—Co. Grey, Ont.
Lamb, James W.

Dundas—Co. Wentworth, Ont.
Bogert, T. J.
Knives, W. E. B.
Oster, Guyton.
R. B. Oster, Q. C., H. G. Guyton.
Wardell, A. E.

Dunville—Co. Haldimand, Ont.
Sulder & Sulder.
C. G. Sulder, T. A. Sulder.
Stevenson, F. S.
Sweeney, W. D.
Waters, G. J.
W. R. Waters, J. C. Rozell.

Durham—Co. Grey, Ont.
Miller, James.
McKeon, G. J. J.
Pringle & Tibbels.
E. A. Pringle, F. P. Tibbels.

Dutton—Co. Eden, Ont.
Clay, H.

Edmonton—N. W. Territory.
Waters, G. J.
Shaw, C. L.

Edmundston—Madawaska Co., N. B.
Bélair, A. Bélair.
Lafort, Frederick.
Plant, Harry R.

Essexville—Co. Bedford, Ont.
Madsen, H. A.

Essex—Albert Co., N. B.
Yousma, J. Herbert.

Elora—Co. Wellington, Ont.
Burns, Edward.
Coffey, Field & Winkler.
T. C. Coffey, G. W. Field, H. Winkler.
Jacob & Gordon.
John Jacob, W. H. Gordon.

Emerson—Manchester Co., Man.
Burnham, Fred E.
McKay, Archibald.

Erie—Co. Wellington, Ont.
McDowell, W.

Essex Centre—Co. Essex, Ont.
Clark & Winkler.
A. H. Clark, E. A. Winkler.
Kennedy, A. E.

Exeter—Co. Huron, Ont.
Dickson, L. H.
Elliot, Benjamin V.
McFadden, Moses.

Farnham—Dis. Bedford, Que.
Bouchard, J. E. Z.
Maurin, J. B.
Poulin, J. B.

Fenelon Falls—Co. Victoria, Ont.
Douglas, J. W.

Fergus—Co. Wellington, Ont.
Lindsay, J. C.
Munn & Muir.
Neil M. Muir, J. Muir.

Forest—Co. Lambton, Ont.
Porte, W. J.

Fort Erie—Co. Welland, Ont.
Stanton, J. F.

Fort Macleod—N. W. Territory.
McNeil, C. C.

Fort Qu'Appelle—North West Territory.
McDonald, H. A. J.
Smith, William.

Fraserville—Dis. Kamouraska, Que.
Dunham, L. V.
Bonne, L. B.
Dunne, Alf.
Lebel & Desautel.
(See Lebel-Desautel.)
Langille, L. A.
Pouliot & Pouliot.
(J. E. Pouliot, C. E. Pouliot.)
Tuche, F. V.

Fredericton—York Co., N. B.
Blair & Barry.
(Blair, Hon. A. G. Barry, J. H.)
Beckwith, Charles W.
Blair & Barry.
(J. Blair, J. D. Hazen.)
Coy, Harvey.
Fisher & Fisher.
(C. H. Fisher, Q. C., G. Fred Fisher.)
Freese, J. Arthur.
Gregory, G. F.
Gregory & Gregory.
(Albert J. Gregory, F. B. Gregory.)
Jack, W. R.
Lynch, Charles H.
McLennan, James W.
McMann, James B.
Quinn, William A.
Lambford, Henry P.
Sharkey, James L.
Stewart, William W.
Van Wert, J. A. & W.
Winkler & Jordan.
(E. Bryan Winkler, D. Jordan.)
Wilson, William.

Gagetown—Queens Co., N. B.
Curry, James H.
Harting, Charles A.
Wetmore, Medley.

Galt—Co. Waterloo, Ont.
Alley & Weir.
(F. Alley, J. J. A. Weir.)
Ball, G. W. H.
Beaumont, K. J.
Boyers, George
Daisell, J. B.
Dunand, C. A.

Gannaque—Co. Leeds, Ont.
Campbell, —
Carroll, William B.
Roe, James C.

Georgetown—Co. Halton, Ont.
Goodwill, George S.
Hilton, Allen & Baird.
Toronto (Branch).

Gesto—Co. Essex, Ont.
Davis, O. B.

Gladstone—Westbourne Co., Man.
Claxton, G.

Glenboro—Manitoba.
Chambers, J. H.

Glenora—Co. Middlesex, Ont.
Blackburn, H. B.
Borton, William.
Russett, Alexander.

Goderich—Co. Huron, Ont.
Cameron, Holt & Cameron.
M. C. Cameron, J. C. P. Holt, M. G. Cameron.
C. C. Holt.
Campbell, Edmund.
Davison & Johnston.
(J. Davison, F. W. Johnston.)
Garrow & Prindoff.
(J. T. Garrow, Q. C., William Prindoff.)
Hayes, H. C.
Lewis, H. C.
Russett & Lewis.
(C. Russett, Jr., R. N. Lewis.)

Grand Falls—Victoria Co., N. B.
Kerwin, W. Fred.

Gravenhurst—Muskoka Dis., Ont.
McCarthy, Peter & McCarthy.
Barnes (Branch).

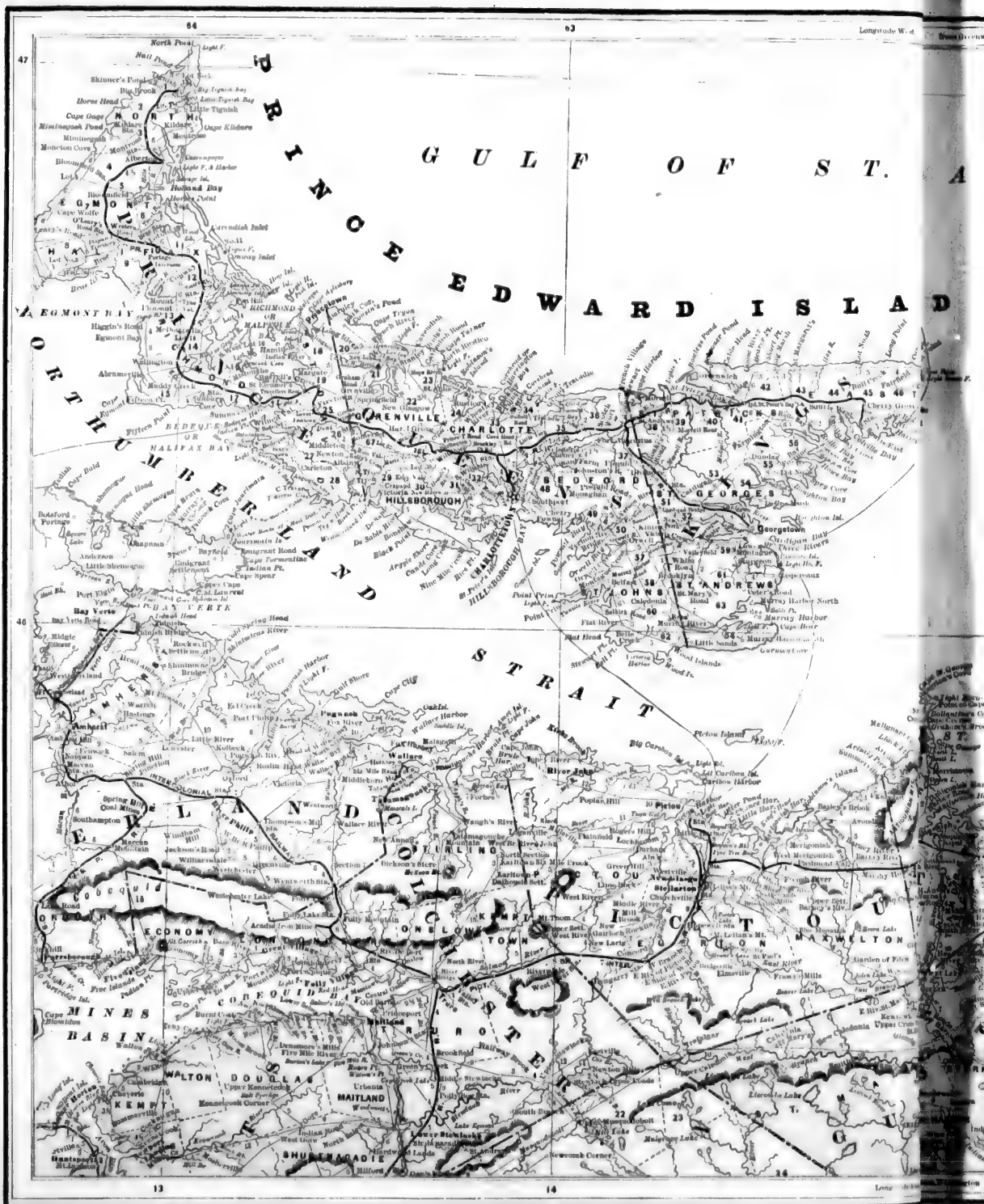
Grimsby—Co. Lincoln, Ont.
Lancaster, S. A.

Guelph—Co. Wellington, Ont.
Collier, Field & Winkler.
T. C. Coffey, G. W. Field, H. Winkler.
Cutter, W. H.
Guthrie & Watt.
(Guthrie, Q. C., J. Watt.)
Macdonald, A. H.
Mowat, J. A.
Mitchell, Robert.
Murphy, J. L.
McLean, W. A.
McLean, Kenneth.
McMillan, H.
O'Connor, Edward.
Peterson, W. H.
Saunders, Thomas W.
Wardrop, W. H.

Gurthorough—Gurthorough Co., N. B.
McIntyre, Alexander H.
Tremblay, Rufus A.

Halifax—Nova Scotia.
Bell, F. H.
Boak, H. W. C.
Clarke, Howard.
Dewar, Lewis W.
Dunn, Walter K.
Katon, Parsons & Beckwith.
R. H. Katon, Q. C., J. Parsons, R. L. Beckwith.
Foster, Foster V. M.
J. A. Forbes, W. A. Foster, W. A. Mills.
Gould, John M.
Graham, Tupper, Borden & Parry.
W. Graham, Q. C., Chas. H. Tupper, R. L. Borden, W. F. Parker.
Harrington & Chisholm.
C. S. Harrington, Q. C., John Chisholm.
Hartley, W. H. M.
Henry, Ritchie & Weston.
H. M. D. Henry, Q. C., T. Ritchie, B. A. Weston.
Hunt, J. J.
Johnston, F. W.
Lindsay, M. W.
Lynch, Peter, Q. C.
Lynn & Mooney.
J. N. Lynn, P. C. Mooney.
MacKay, Pearson, Morrison & Forbes.
W. F. MacKay, Q. C., R. F. Pearson, A. G. Morison, F. Forbes.
McDonald, Alex.
McDonald, John.
McLellan, W. M.
Newcomer, William B.
Mowbray, Drysdale & Newcombe.
A. H. Mowbray, Q. C., A. Drysdale, E. L. Newcombe.
Monger, John.
Morton & Longley.
Robt. Morton, Hon. J. W. Longley.
Outram, Fred E.
Payant, John Y. Q. C.
Petra, Albert.
Power, Hon. L. G.
Ritchie, Geo.
Ross, John T.
Russell & Condon.
(R. Russell, F. C. Condon.)
Sedgewick, Ross & Sedgewick.
R. Sedgewick, Q. C., Wm. B. Ross, J. A. Sedgewick.
Shannon & Bligh.
Hon. S. L. Shannon, Q. C., Fred P. Bligh.
Smith, C. H.
Thompson & Bullock.
James Thompson, Q. C., C. B. Bullock.
Tremaine, F. J.
Twining, William.
Wheeler, T. J.
Wicks & Fielding.
(G. S. Wicks, G. H. Fielding.)
Whitman, A. (A. Whitman, A. E. Silver.)

Hamilton—Co. Wentworth, Ont.
Baker, Samuel.
Barton, G. M.
Bell & Thompson.
(W. Bell, G. C. Thompson.)
Brace, Burton & Co.
(Alex. Bruce.)
W. F. Burton, J. A. Co.
Cahill, James.
Cameron & Witherspoon.
(A. D. Cameron, R. W. Witherspoon.)
Carrington & Cahill.
(H. Carrington, R. D. Cahill.)
Creser & Muir.
(J. Creser, J. Muir.)
Creser & Daulton.
(P. D. Creser, P. M. Bankier.)
Duff, W. A. H.
Fitzgerald, Francis.
Fuller, Nephil & Hargrell.
(V. E. Fuller, J. W. Nephil, James Bicknell.)
Furlong & Beasley.
(Edward Furlong, Alex. C. Beasley.)
Gage & Jells.
(R. R. Gage, G. F. Jells.)
Hassett & Washington.
(T. C. Hassett, G. F. Washington.)
Irvine, Emilia, Q. C.
Jones, J. V.
Kuger & Lee.
(S. D. Kuger, Lyman Lee.)
Lester & Moore.
R. F. Lester, J. F. Moore.
Lynch, Charles.
Livingstone, W. C.
Macdonald, Walter H.
MacKellan, Gibson & Gansby.
(F. MacKellan, Q. C., J. M. Gibson, J. B. Gansby, George E. Martin.)
MacKellan & McWhir.
(F. MacKellan, Q. C., S. McWhir.)
Maline, M.
Martin, George & Martin.
(R. Martin, Q. C., R. E. Martin, E. Martin.)
Mills, George H.
McIntyre & Chisholm.
(I. B. McIntyre, James Chisholm.)
Carr, Thomas.
(R. B. Carr, Q. C., R. V. Tassell, John Carr.)
Papp, J. A.
Parks & MacAdam.
(J. Parks, A. F. MacAdam.)
Pringle, R. A.
Patten, L. H.



T. A W R E N C E

L A D

N
A
C
O
C



PRINCE EDWARD ISLAND
AND
NOVA SCOTIA
PLATE 3.

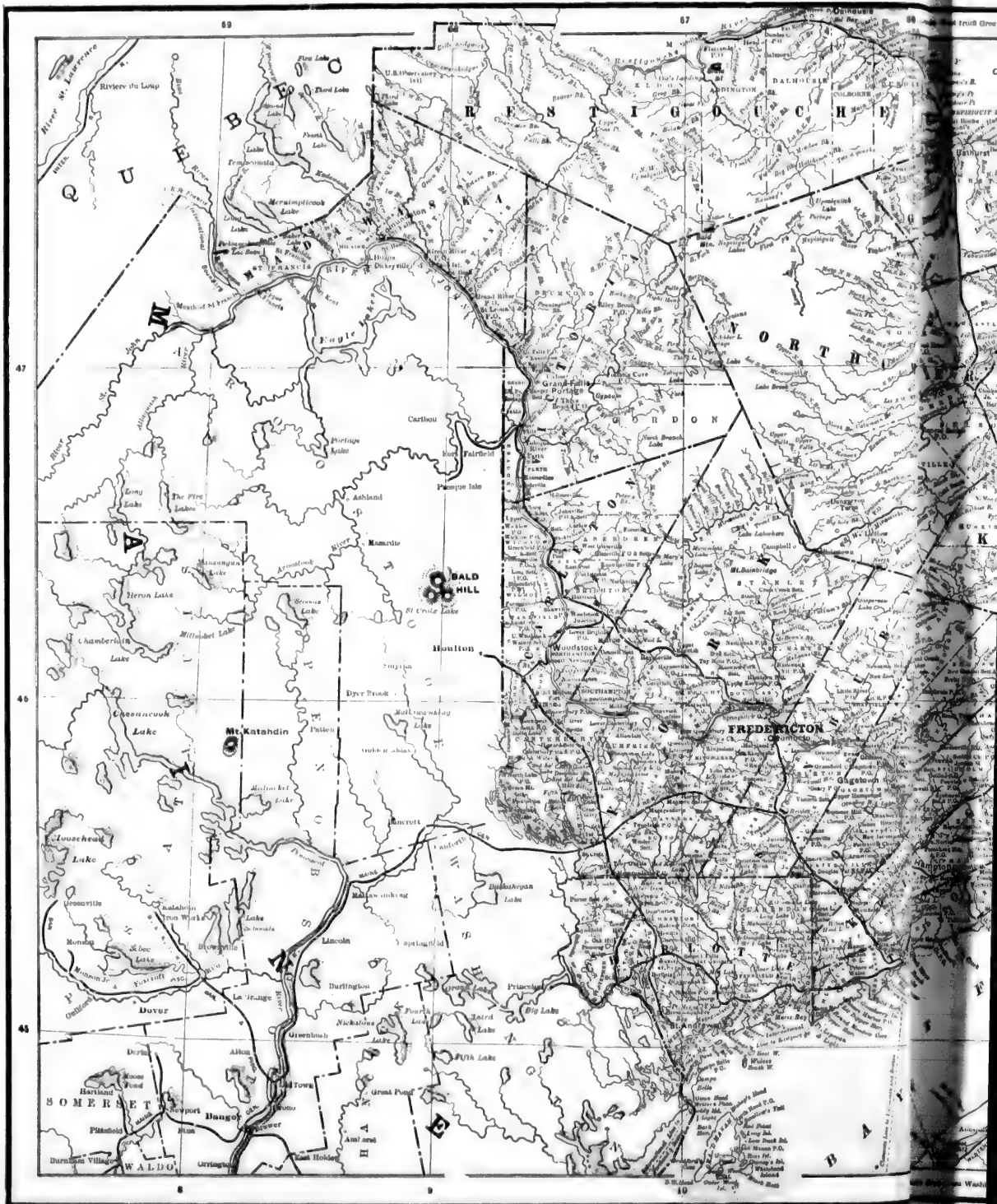
Geo. F. Cram, Engraver,
Chicago, Ill.

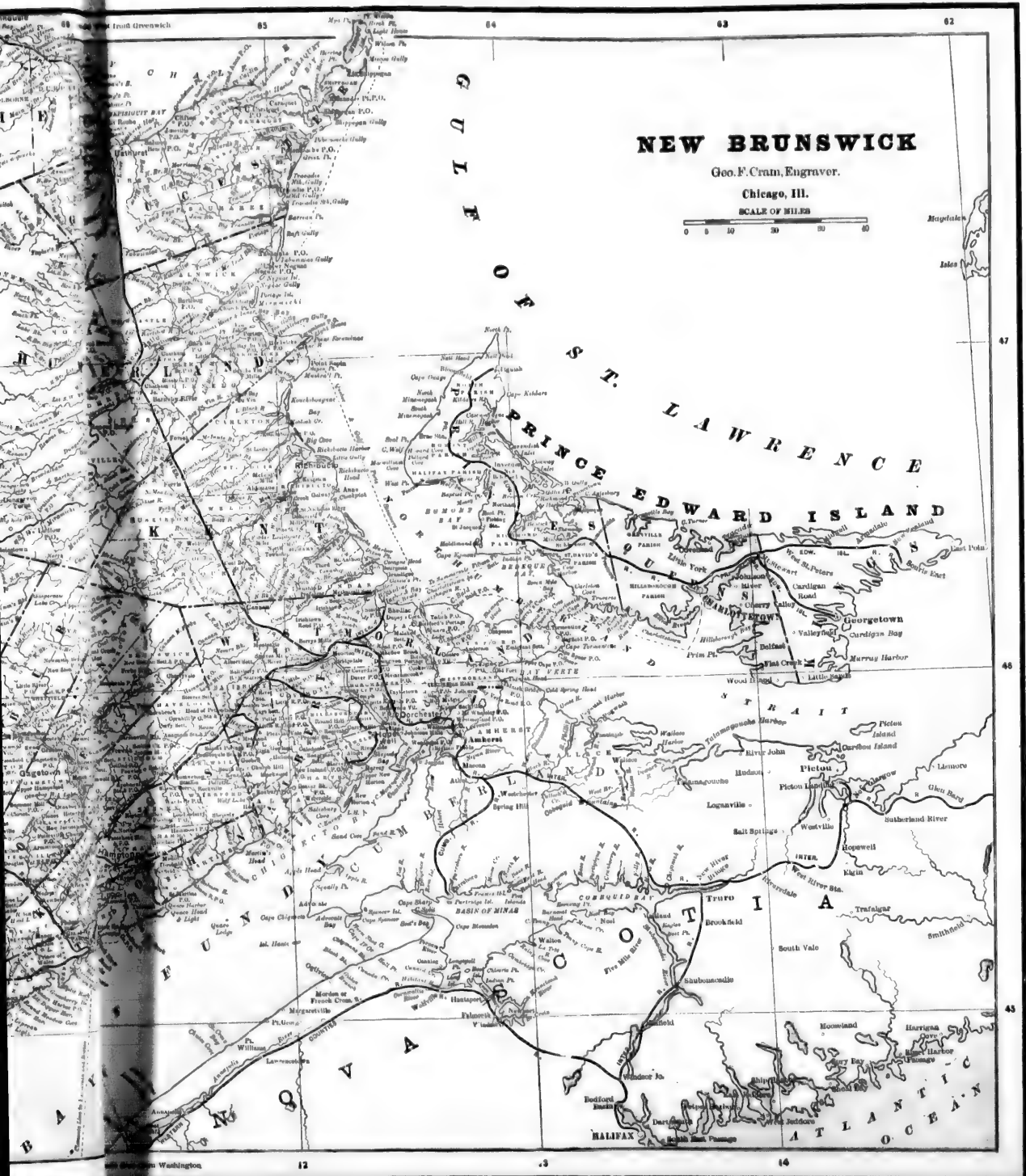
SCALE OF MILES



DOMINION OF CANADA.

59





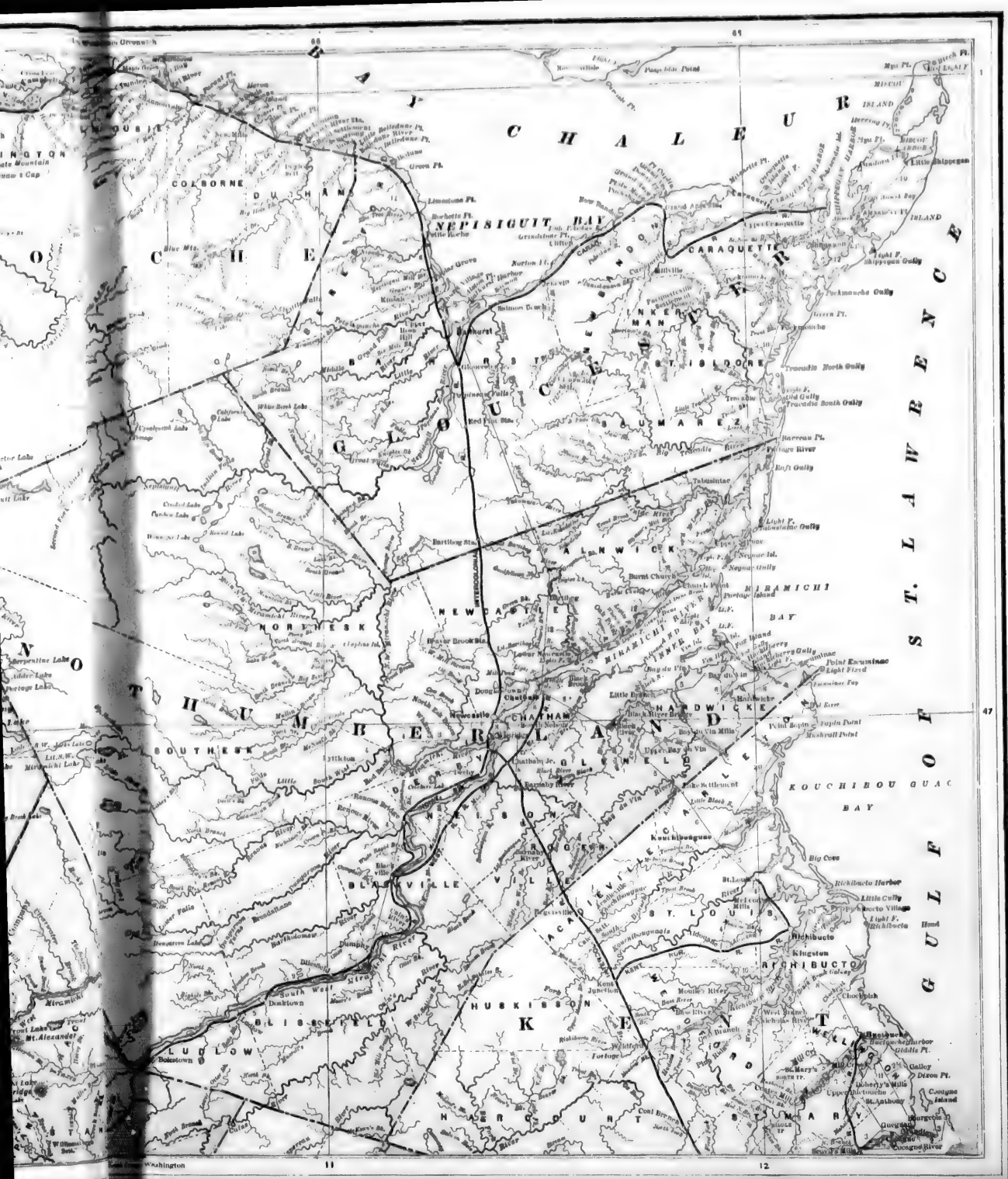
NEW BRUNSWICK

Geo. F. Cram, Engraver.

Chicago, Ill.

SCALE OF MILES





DOMINION OF CANADA.

Welland—Co. Welland, Ont.

Gorman, W. M.
Harcourt & Cowper.
(R. Harcourt, T. D. Cowper.)
Lennon, J. Elliot
Raymond & Raymond.
(L. D. Raymond, L. Clark Raymond.)
Williams, Adolphus

Wernmouth—Digby Co., N. S.

Smith, Joseph A.
Whitby—Co. Ontario, Ont.
Billings, W. H.
Dow, John B.
Farwell, John R.
Gordon, James K.
Greenwood, J. Homer
Grimston, D.
Butteridge, James
Smith & Smith.
(G. Young Smith, John J. Smith.)

Wlarton—Co. Bruce, Ont.

Walker, Robert

Winchester Springs—Co. Dundas, Ont.

Grimm, J. G.
Windsor—Co. Essex, Ont.
Bell, John P.
Berlert, N. A.
Cameron, Cleary & Sutherland.
(A. Cameron, P. Cleary, R. F. Sutherland.)
Crickmore, C. Har-
rington, Dunc-
Fleming, Cae-
Hanna, J. W.
Macdonald, J.
Morton, T. Mercer
Ouellette, Joseph A.
Panel, P.
Patterson & McHugh.
(J. C. Patterson, M. H. McHugh.)
White & Ellis.
(S. White, H. T. W. Ellis.)
Wilkinson, James H.

Windsor—Hants Co., N. S.

Blanchard & Blanchard,

Windsor—Contd.

W. H. Blanchard, Aubrey Blanchard.
Blanchard, H. Percy
Chadwick, William M.
Hoadley, H. H.
King, George H.
Lusley, John W.
Mead, Percy
Sutherland, W. D.

Wincham—Co. Huron, Ont.

Meyer & Dickinson.
H. W. G. Meyer, R. L. Dickinson.
Metz, A. U.
Morton, J. A.

Winnipeg—Selkirk Co., Manitoba.

Aikens, Culver & Hamilton.
(J. A. M. Aikens, Q. C., W. H. Culver, C. F.
Hamilton, Q. C., A. V. McCreaghren, G. G.
Mills, W. B. Long.)
Andrews, Carbert & Andrews.
(G. A. F. Andrews, C. E. Carbert, A. J. An-
drews.)
Archibald & Howell.
(Heber Archibald, H. M. Howell, Q. C.)
Ashbaugh, R. L.
Bain, Perdue & Robinson.
(J. P. Bain, W. E. Perdue, T. Robinson.)
Barr, Joseph
Beck, N. H.
Bice, Dawson & Curran.
(S. C. Bice, Q. C., A. Dawson, J. Curran.)
Campbell & Crawford.
(C. H. Campbell, H. E. Crawford.)
Canacut, W. B.
Carr, Daniel
Cassidy, Robert
Clarke & Clarke.
(H. J. Clarke, Q. C., Frank J. Clarke.)
Clarke, George H.
Cumberland, T. D.
Davis & Gillmore.
(T. H. Gillmore, Ghent Davis.)
Ewart, Fisher & Wilson.
(John S. Ewart, J. Fisher, C. P. Wilson.)
Elliot & Chaffey.
(G. A. Elliot, B. E. Chaffey.)
Ferguson, D.
Ferguson, W. J.

Winnipeg—Contd.

Forlin, E. K.
(Glas & Glas.
(David Glas, Chester Glas.)
Haggar & Rose.
(A. Haggar, James A. Rose.)
Hagel, N. F., Q. C.
Hough & Campbell.
(J. S. Hough, Isaac Campbell.)
Howard, J. R.
Howard, A.
Kennedy, Thomas S.
Macdonald & Sutherland.
(H. G. Macdonald, R. Ross Sutherland.)
Macdonald, Tupper & Phipps.
(Hugh J. Macdonald, J. S. Tupper, F. H. Phip-
ps, W. J. Tupper.)
Macdonald, Allan
Maclean, H. A.
Mackinnon, A.
Mackie, Allen & Townley.
(J. D. Mackie, C. B. Allen, T. O. Townley.)
Mabee, W. Bedford
Muir, G. F.
Munson & Allen.
(J. H. D. Munson, G. W. Allen.)
McArthur, Dexter & Denovan.
(J. B. McArthur, Q. C., H. J. Dexter, J. Den-
ovan.)
McKenzie, F. Q. C.
McNevin, E.
McPhillips, Wilkes & McPhillips.
(J. D. McPhillips, A. E. Wilkes, Albert E.
McPhillips.)
Nason, H.
Nugent & Jamieson.
(F. S. Nugent, H. W. Jamieson.)
O'Reilly, John
Patterson & Baker.
George Patterson, G. Baker.
Preud'homme & Turnbull.
(J. P. Preud'homme, H. Turnbull.)
Richards, Brophy & Darby.
(A. E. Richards, G. Brophy, J. W. E. Darby.)
Robertson, F. B.
Roe, John
Robertson & Roberts.
(J. J. Robertson, J. T. Roberts.)

Vivian & Curran.

(R. Vivian, J. P. Curran.)
Wade, F. C.
West, G. H.
Wilson, J. W. H.
Wood, E. M.

Wolfville—Kings Co., N. S.

Crawley, E. Sidney
Wallace, John W.

Woodstock—Co. Oxford, Ont.

Bell & Bell.
(P. H. Bell, Q. C., Albert S. Bell, H. N. Bell.)
Beard, Nellie & Bevell.
(H. B. Beard, Q. C., J. H. Nellie, Robert
Bevell.)
Bird & Martin.
(Robert Bird, F. C. Martin.)
Duncan, H. J.
Finkle, McKay & McMullen.
(H. J. Finkle, S. G. McKay, W. T. McMullen.)
Fletcher & Wallace.
(A. Fletcher, J. G. Wallace.)
Norris, William
Oliver & Mackay.
(C. W. Oliver, J. S. Mackay.)
Smith, George
Totten, Warren

Woodstock—Carleton Co., N. B.

Appleby, Stephen B.
Connell, William M.
Fisher & Connell.
(L. P. Fisher, A. B. Connell.)
Jones, H. K.
Murphy, Joseph H.
Winslow, J. Norman
Vince, D. McLeod

Yamachiche—Des. Three Rivers, Que.

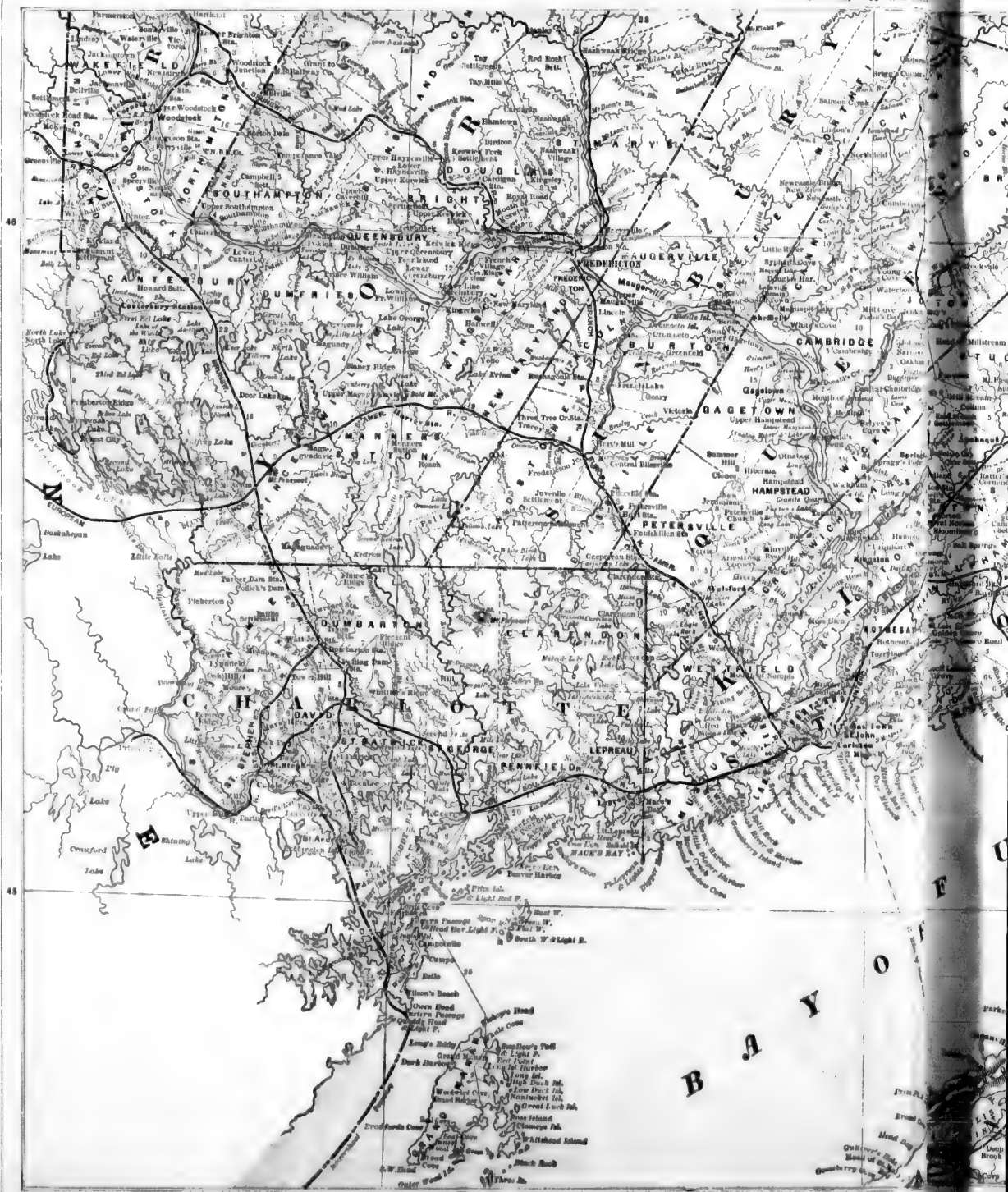
Dorion, H.
Yarmouth—Yarmouth Co., N. S.
Thomas, T. B. Biny & Sons,
Coring & Chipman,
Flinn, Thomas B.
Grant, Henry A.
Harris, Robert E.
Pelton & Clements.
(S. H. Pelton, Q. C., Edgar N. Clements.)

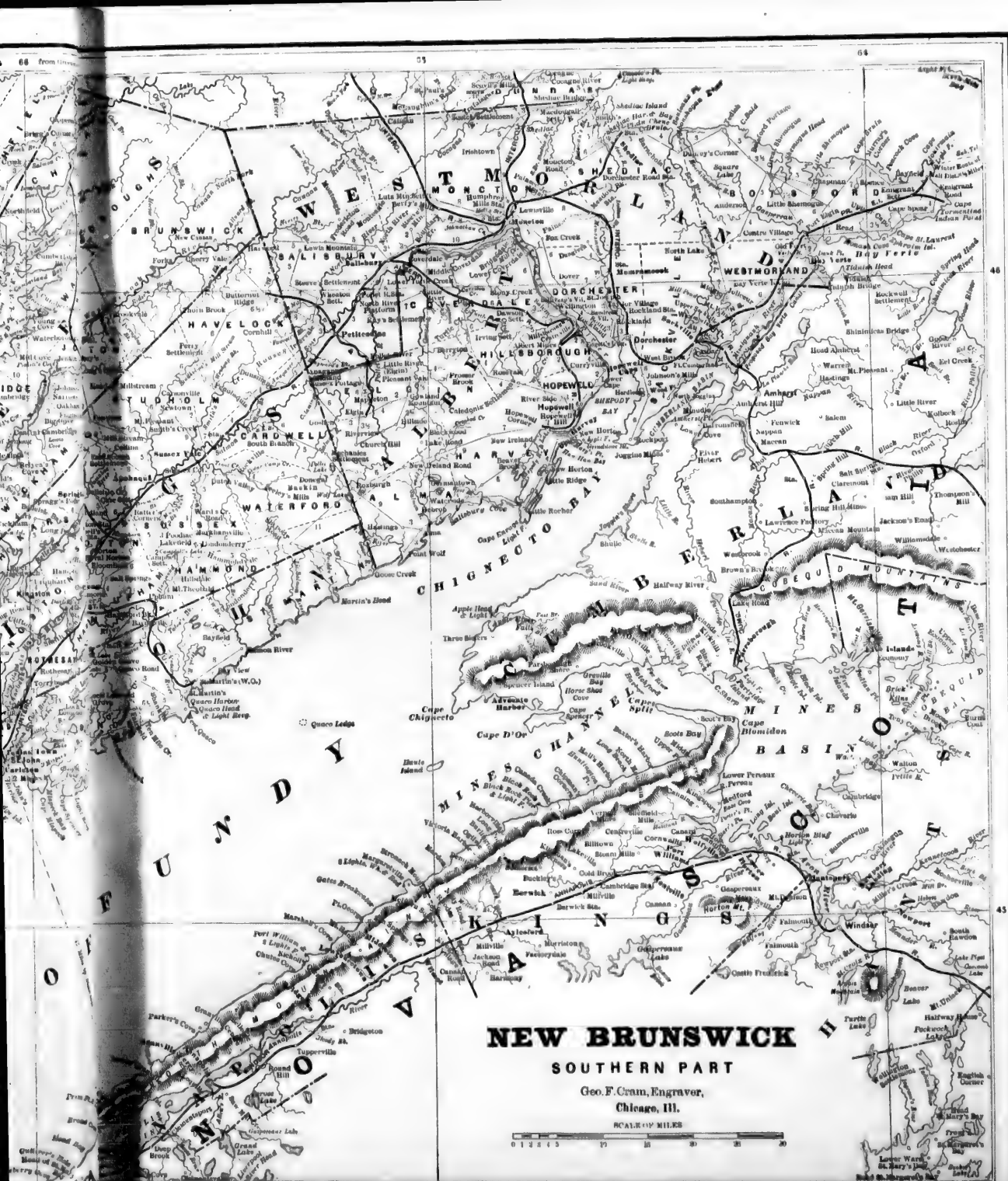


McMullen.)

McMullen.)

McMullen.)



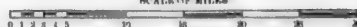


NEW BRUNSWICK

SOUTHERN PART

Geo. F. Cram, Engraver,
Chicago, Ill.

SCALE OF MILES



DOMINION OF CANADA.

[illegible][illegible][illegible]

PRIVATE BANKS IN DOMINION OF CANADA.

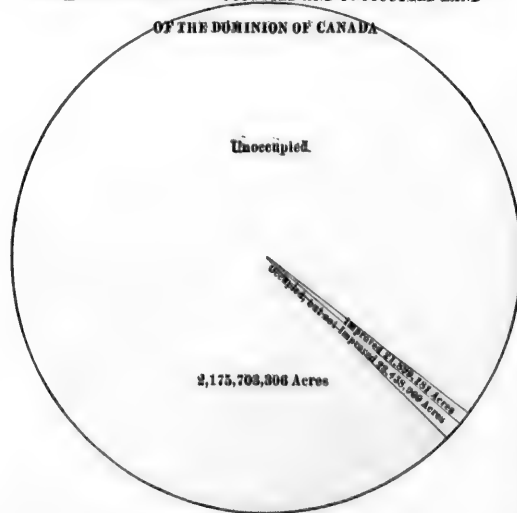
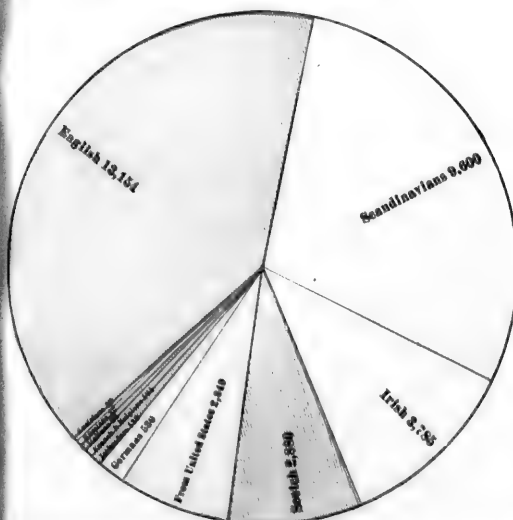
[illegible]

TABLE ILLUSTRATING THE QUANTITY OF FARM PRODUCE ACCREDITED TO EACH PROVINCE
FOR THE YEAR ENDING APRIL 4th, 1881, ACCORDING TO THE LAST CENSUS

	Spring Wheat Bushels	Fall Wheat Bushels	Barley Bushels	Oats Bushels	Rye Bushels	Pean & Beans Bushels	Stock Wheat Bushels	Corn Bushels	Potatoes, Turnips & Other Roots Bushels	Hay Tons
The Territories	119,044	0	48,448	18,038	200	1,291	0	1,948	10,210	12,000
British Columbia	185,385	20,100	70,140	28,011	400	60,048	0	1,168	728,005	45,000
Prince Edward Island	54,878	174	119,008	2,328,219	0	2,100	90,438	2,305	7,000,170	130,791
Manitoba	1,028,078	4,805	225,004	1,270,700	1,300	5,001	220	2,810	761,914	168,870
New Scotia	58,302	6,610	286,418	1,878,118	47,507	87,280	880,710	18,202	8,711,844	607,781
New Brunswick	57,307	9,709	81,100	2,079,004	10,208	46,121	1,007,000	16,169	8,010,000	115,000
Quebec	1,000,010	10,100	1,757,000	18,000,000	400,000	4,170,400	2,011,070	888,100	10,100,000	1,011,000
Ontario	7,213,054	80,100,000	14,270,041	40,300,000	1,800,071	9,484,070	641,000	5,000,700	10,000,000	2,000,000
Total	12,102,517	90,247,468	18,844,880	70,100,101	2,007,100	18,740,000	4,001,147	9,025,140	108,510,041	8,055,510

DIAGRAM SHOWING THE OCCUPIED AND UNOCCUPIED LAND
OF THE DOMINION OF CANADA

NATIONALITIES OF THE IMMIGRANTS THAT ARRIVED
IN THE DOMINION IN THE YEAR 1881

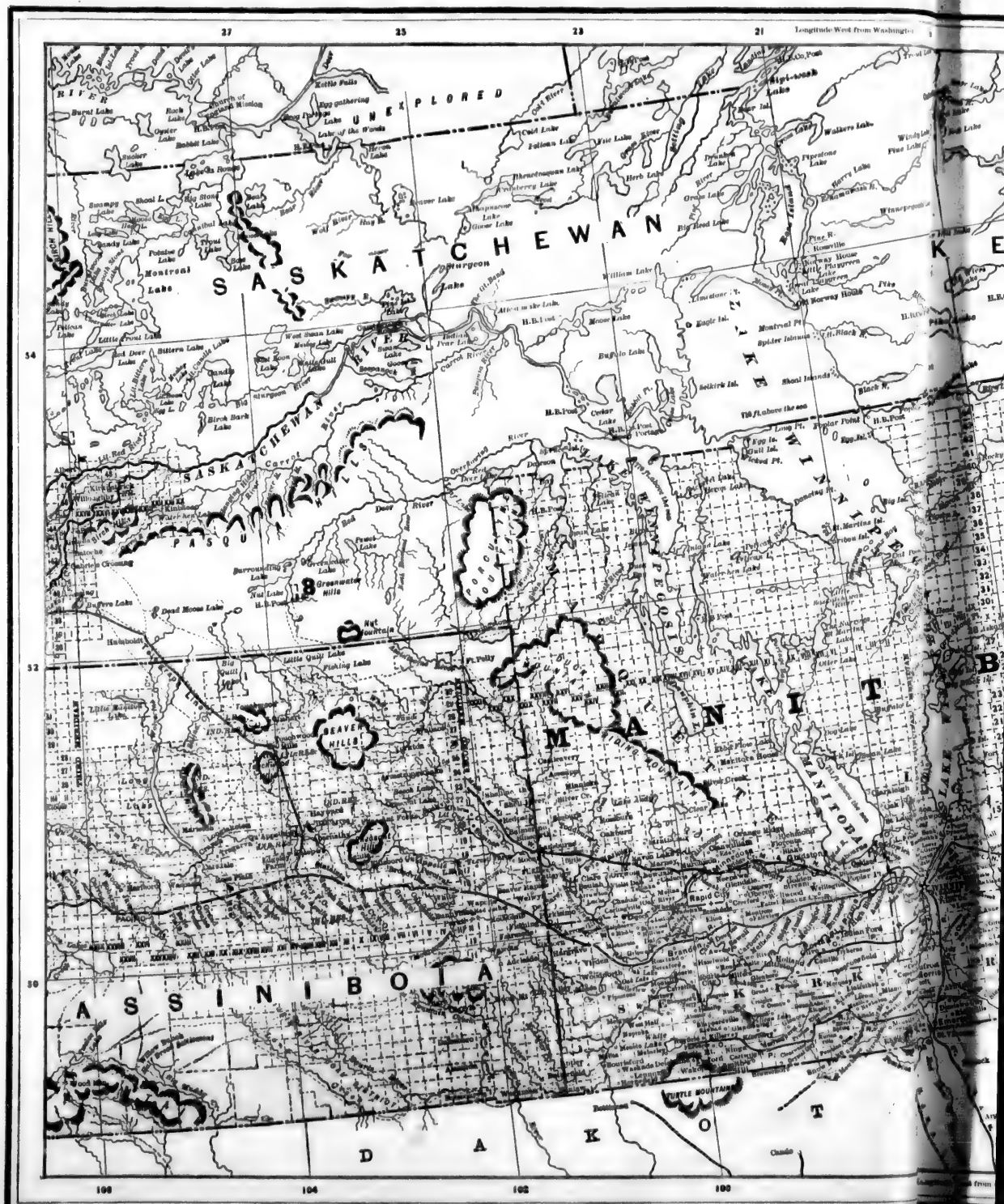


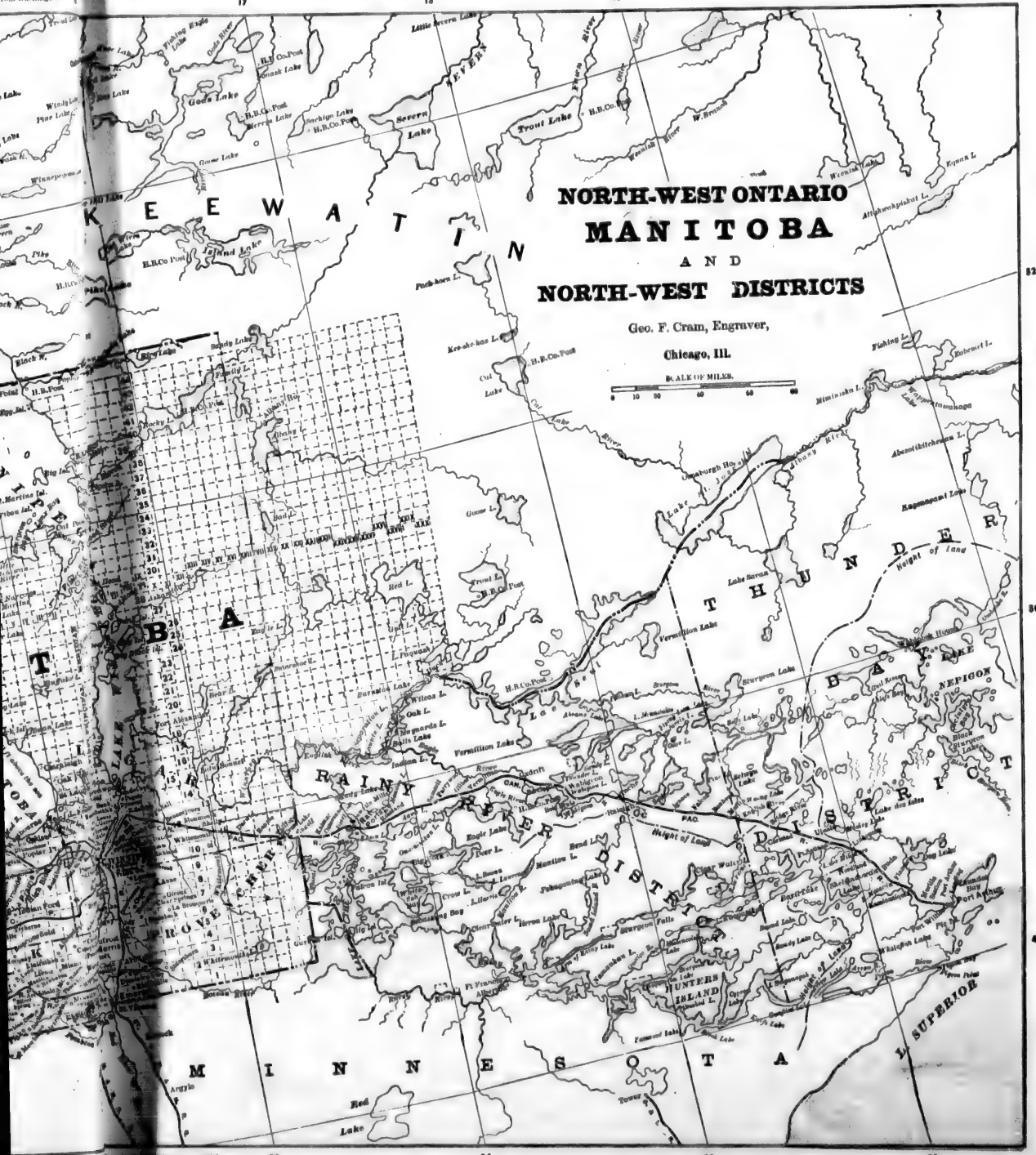
VALUE OF THE DOMINION FISHERIES FOR 1880

TOTAL NUMBER OF IMMIGRANTS ARRIVING IN CANADA FROM 1867 TO 1881

YEAR	SETTLERS	YEAR	SETTLERS
1867	14,000	1875	10,240
1868	12,705	1876	14,440
1869	18,000	1877	15,825
1870	24,700	1878	18,872
1871	27,773	1879	30,717
1872	38,575	1880	27,544
1873	41,070	1881	32,587
1874	25,208		





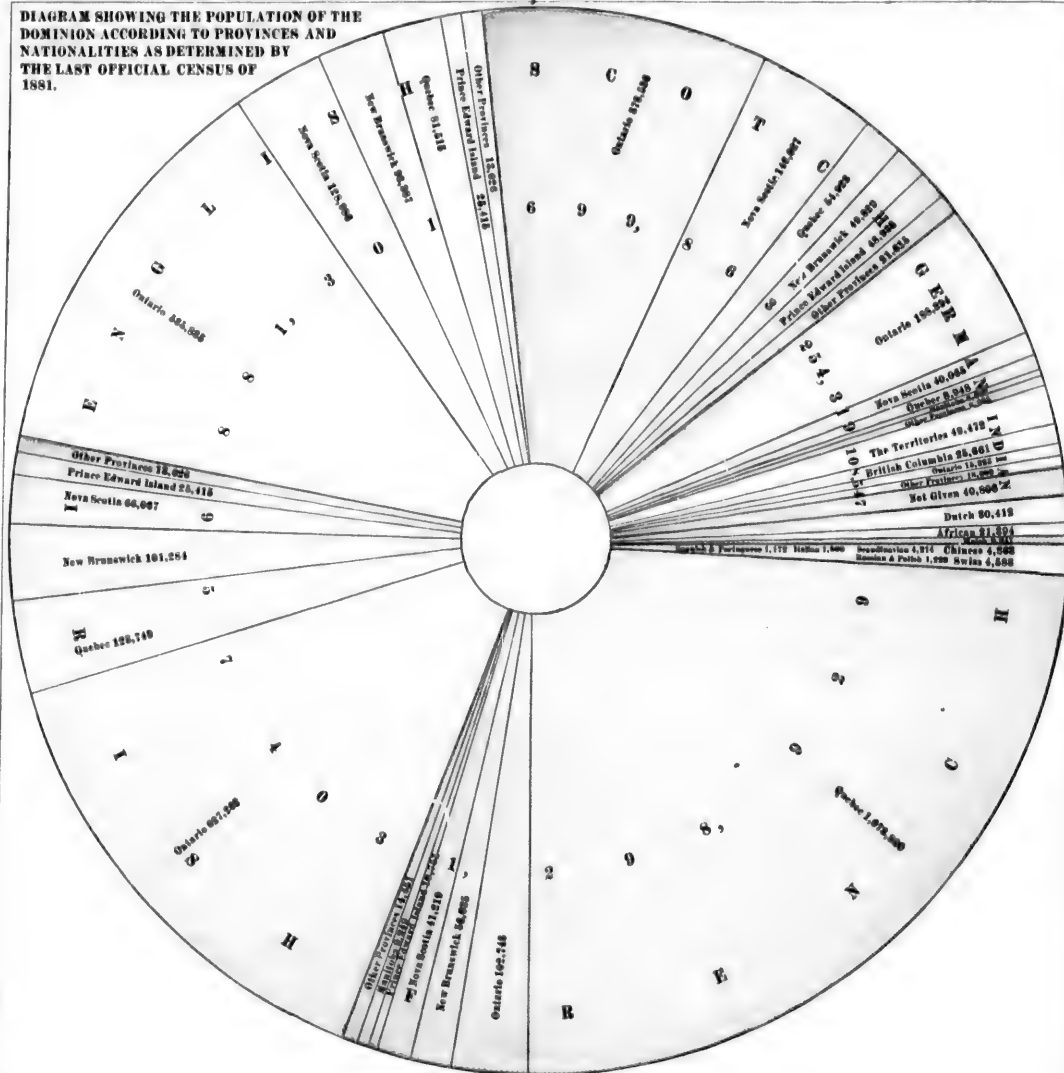


32

30

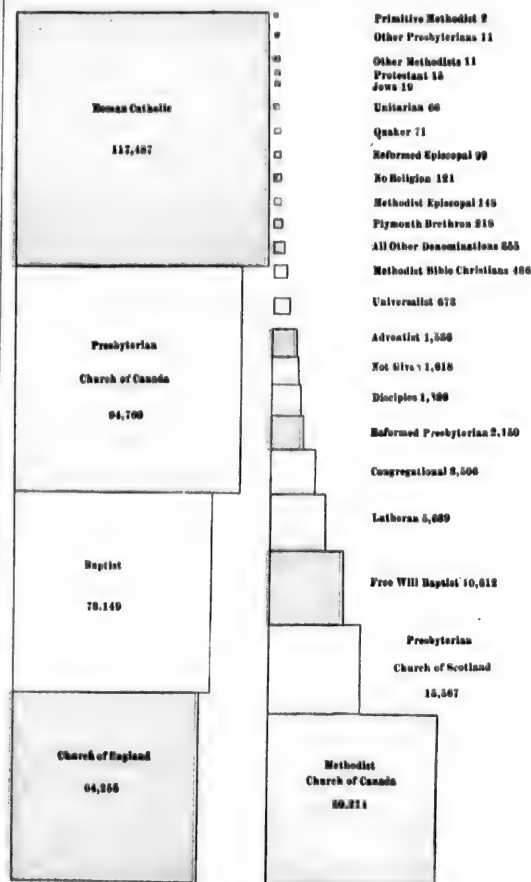
48

DIAGRAM SHOWING THE POPULATION OF THE DOMINION ACCORDING TO PROVINCES AND NATIONALITIES AS DETERMINED BY THE LAST OFFICIAL CENSUS OF 1881.

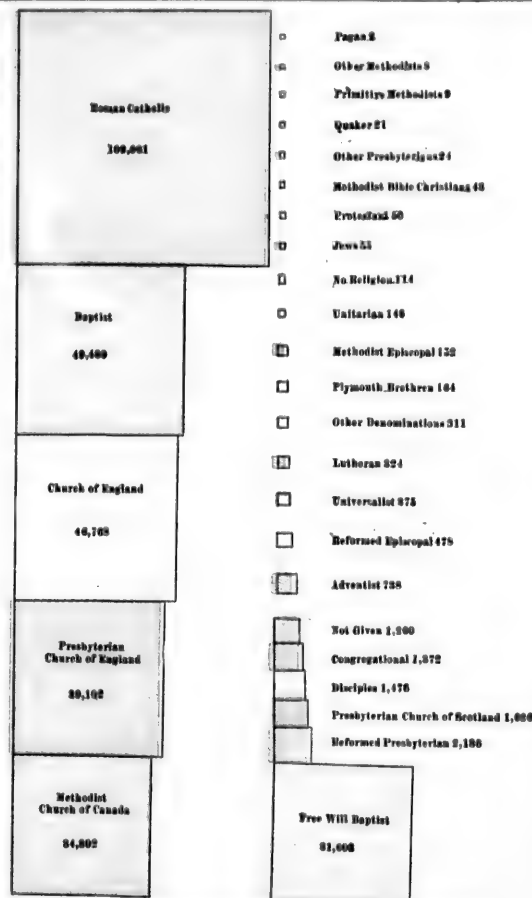


TEMPORARY VESSELS		SHANTIES	RESIDENTS	TOTAL OCCUPIED	HOUSES INHABITED	HOUSES UNINHABITED
16	2,750		British Columbia	9,798	6,999	1,798
1	9,667		The Territories	11,632	7,904	39
2	401		Manitoba	12,008	19,400	700
4	85		Pr. Edward Island	17,724	17,065	659
11	199		New Brunswick	5,166	50,966	9,597
33	880		Nova Scotia	74,154	72,796	2,357
6	514		Quebec	216,085	216,119	10,460
36	1,211		Ontario	339,596	339,364	10,232

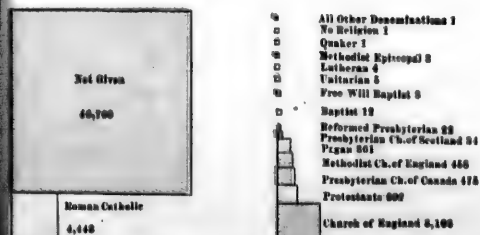
DIAGRAM SHOWING THE TOTAL NUMBER OF OCCUPIED DWELLINGS & THE INHABITED & UNINHABITED HOUSES IN THE DOMINION OF CANADA.



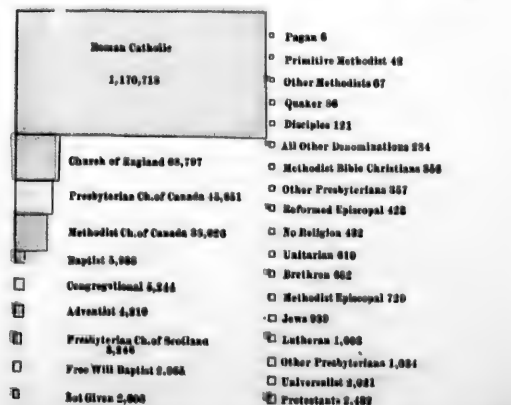
COMPARISON OF THE RELIGIONS OF THE PROVINCE OF NOVA SCOTIA



COMPARISON OF THE RELIGIONS OF THE PROVINCE OF NEW BRUNSWICK



COMPARISON OF THE RELIGIONS OF THE NORTH WEST TERRITORY

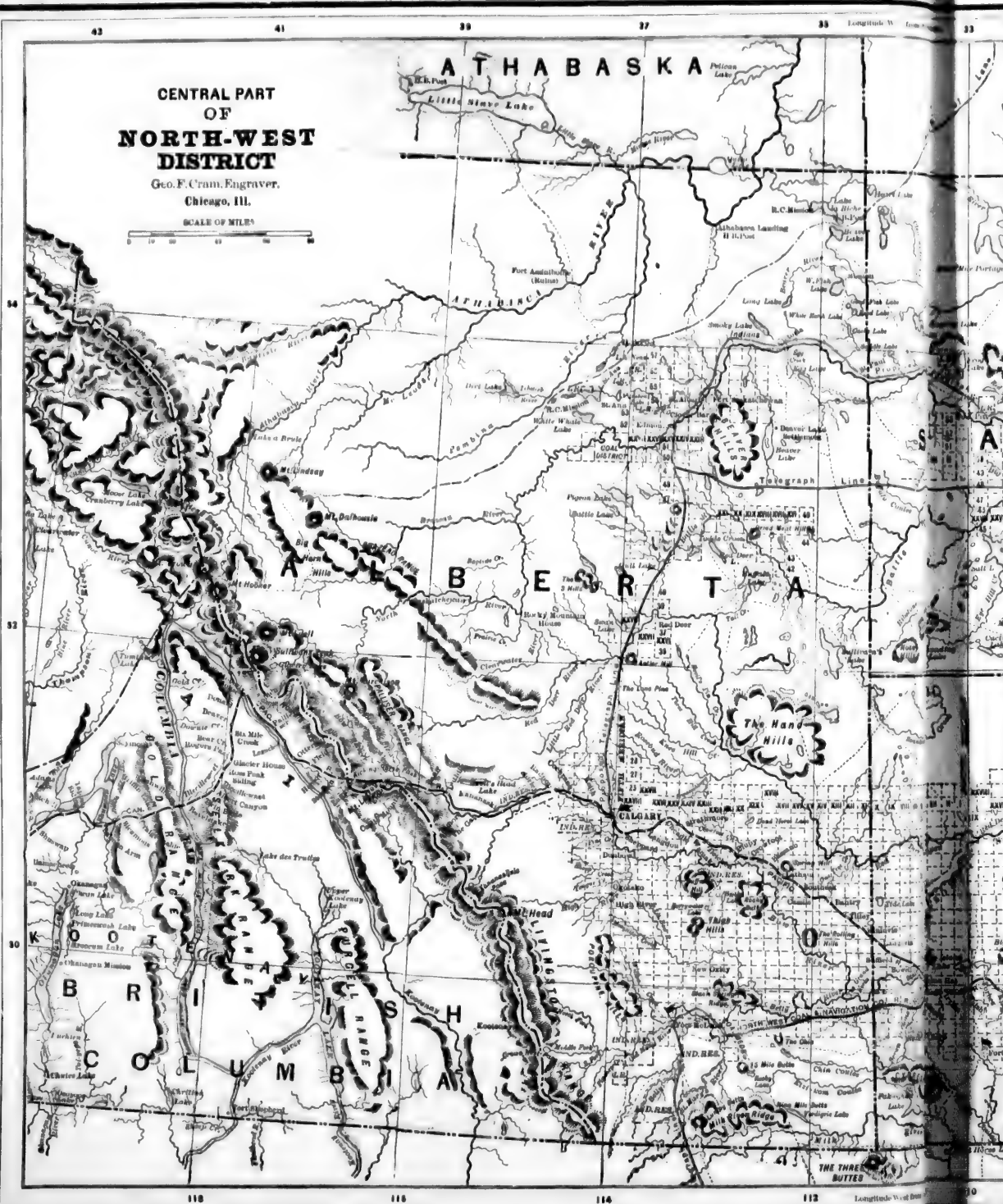


COMPARISON OF THE RELIGIONS OF THE PROVINCE OF QUEBEC

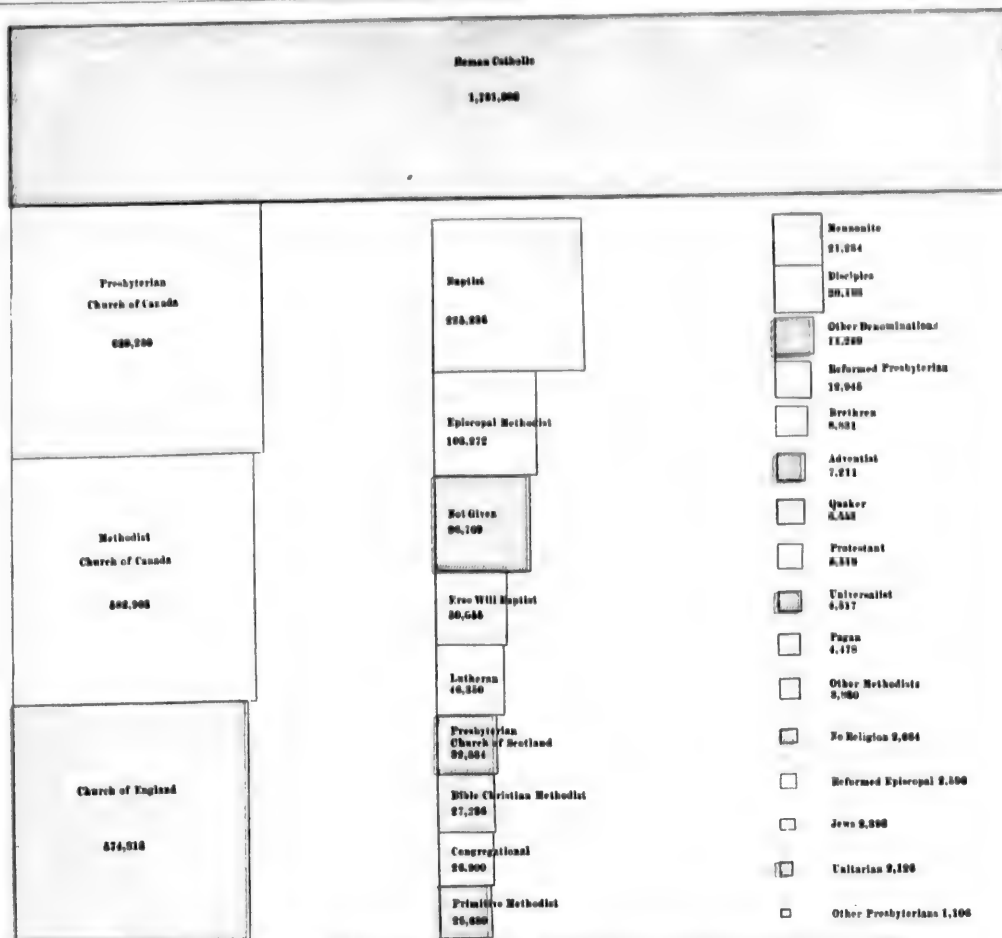
CENTRAL PART OF NORTH-WEST DISTRICT

Geo. F. Cram, Engraver,
Chicago, Ill.

SCALE OF MILES







RELIGIONS OF THE PEOPLE OF THE DOMINION, FROM THE LAST OFFICIAL CENSUS OF 1881.

TABLE OF EXPORTS & IMPORTS & THE AMOUNT OF DUTY COLLECTED IN THE DOMINION OF CANADA SINCE CONFEDERATION.

Years	Total Exports	Exports					Imports					Total Imports	Duty
1860	\$27,567,888											\$73,150,644	\$5,910,461
1865	60,471,781											70,415,165	3,206,909
1870	70,573,490											74,514,399	5,468,940
1871	74,173,010											96,092,071	11,043,646
1872	82,629,063											111,430,627	12,045,498
1873	90,700,223											126,011,331	13,017,700
1874	96,561,920											125,213,600	14,421,000
1875	77,000,079											122,070,308	13,061,300
1876	80,900,435											95,210,346	12,055,114
1877	76,870,990											90,827,900	12,645,451
1878	70,523,067											90,061,707	12,793,600
1879	71,000,688											81,961,331	12,689,450
1880	91,144,444											96,220,747	14,120,940
1881	96,000,000											104,220,040	16,400,000
1882	100,147,000											110,419,000	21,700,000
1883	90,000,000											103,264,000	18,720,000
1884	91,400,000											110,007,000	20,100,000
1885	90,220,000											100,041,000	18,120,000
1886	84,561,814											101,424,561	18,645,128

TABLE SHOWING THE COMPARATIVE VALUE OF
MANUFACTURED ARTICLES PRODUCED IN THE PROVINCES
DURING THE YEAR 1881.

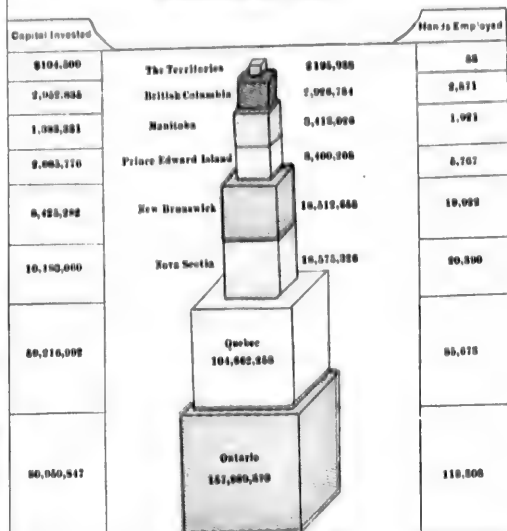


TABLE SHOWING THE QUANTITY OF IRON ORE
PRODUCED FROM THE MINES OF THE
PROVINCES IN 1881.

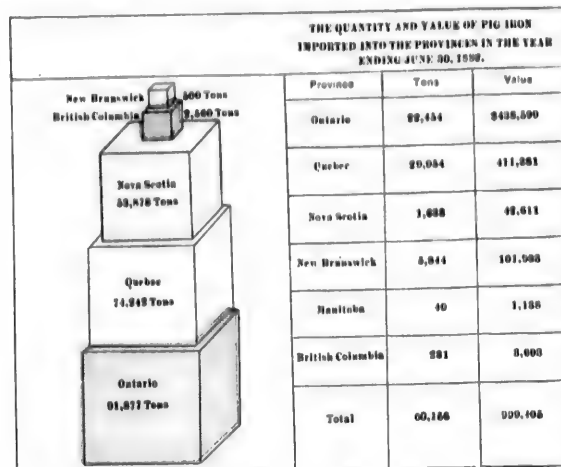


DIAGRAM SHOWING THE AMOUNT OF MERCHANTIBLE
PINE PRODUCED IN THE PROVINCES
DURING THE YEAR 1881.

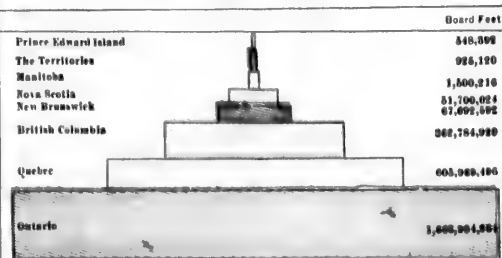
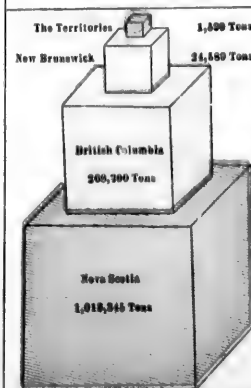


TABLE SHOWING THE TOTAL QUANTITIES OF
FREIGHT PASSED THROUGH THE CANALS OF
CANADA IN THE YEAR 1881.



DIAGRAM SHOWING THE QUANTITY OF
COAL PRODUCED FROM THE MINES OF THE
PROVINCES FOR THE YEAR 1881.



THE QUANTITY AND VALUE OF COAL MINED
AND EXPORTED FROM THE PROVINCES OF THE
DOMINION FOR THE YEAR ENDING JUNE 30, 1882.

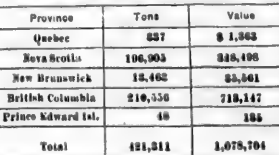
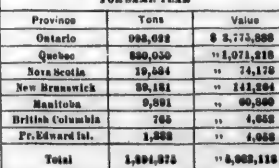
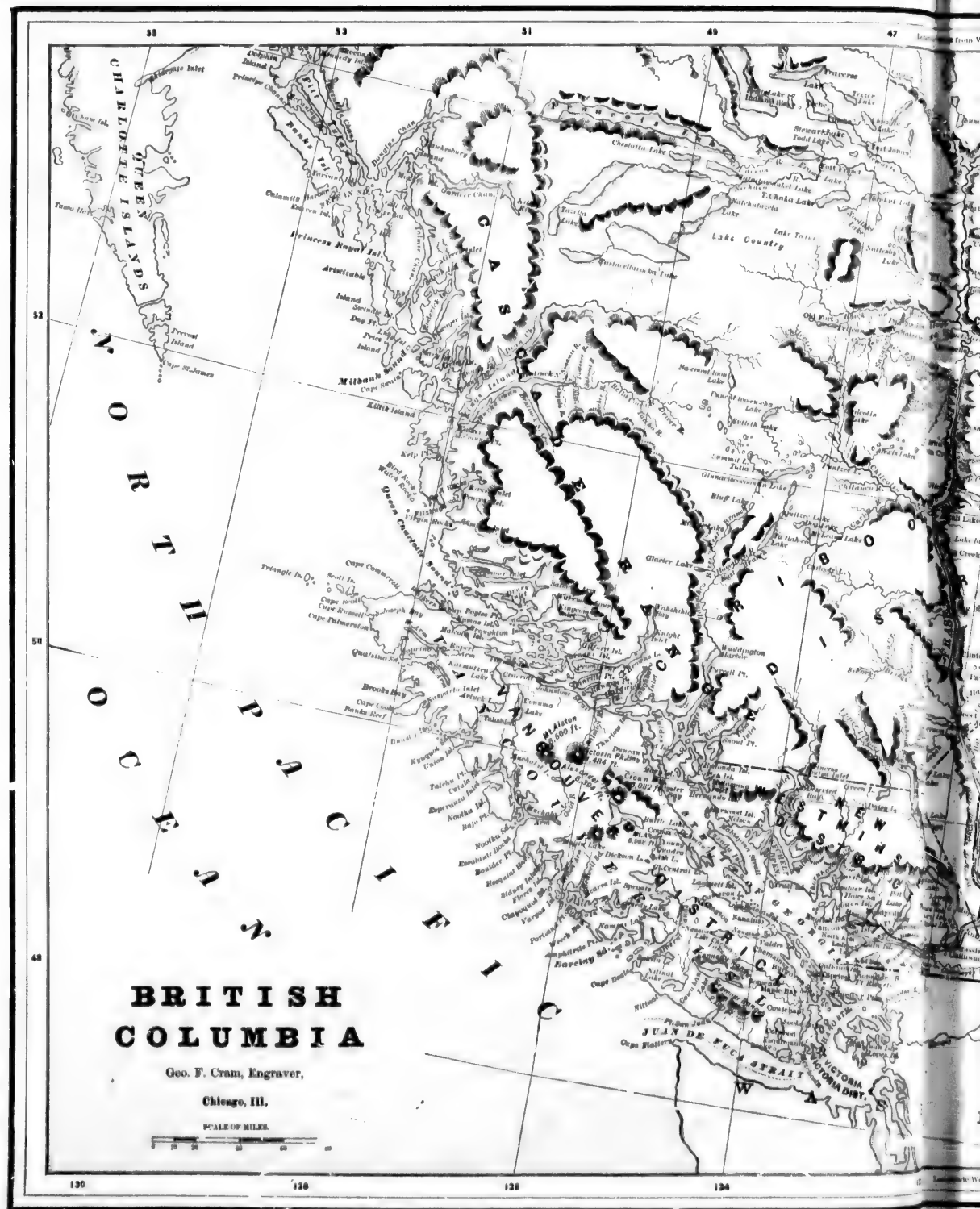


TABLE SHOWING THE VALUE AND QUANTITY
OF COAL IMPORTED INTO THE PROVINCE
FOR SAME YEAR



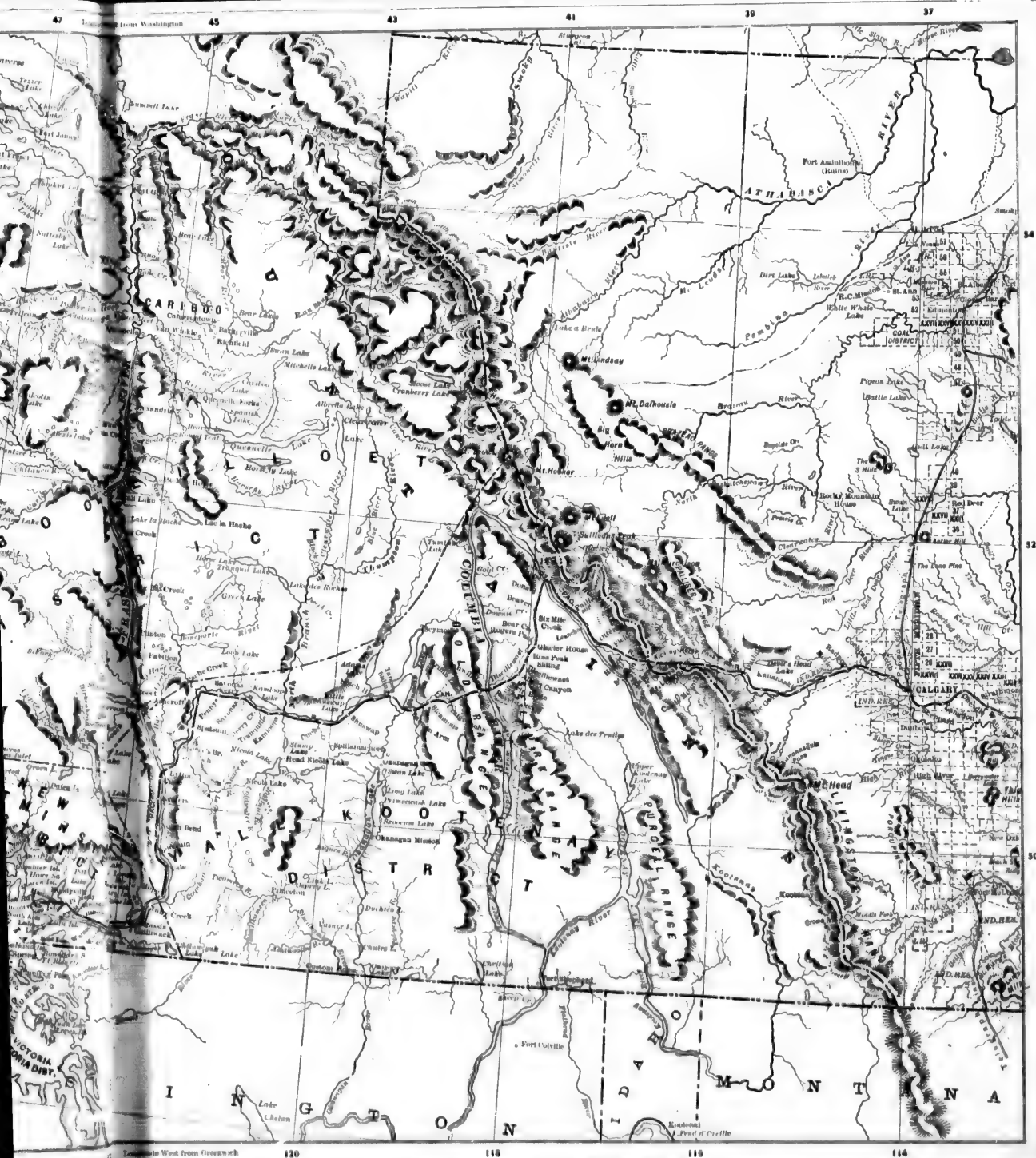


BRITISH COLUMBIA

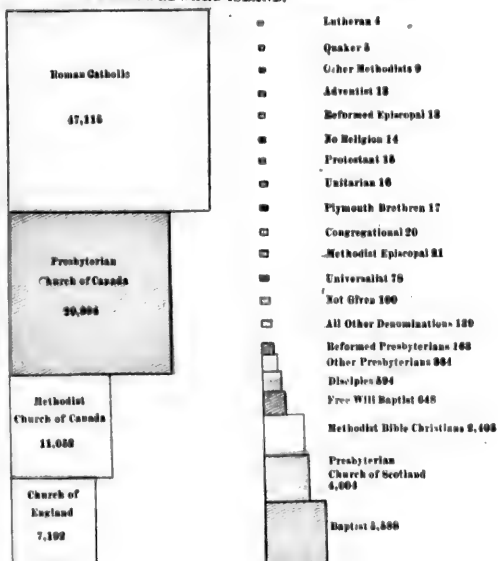
Geo. F. Cram, Engraver,
Chicago, Ill.

SCALE OF MILES.

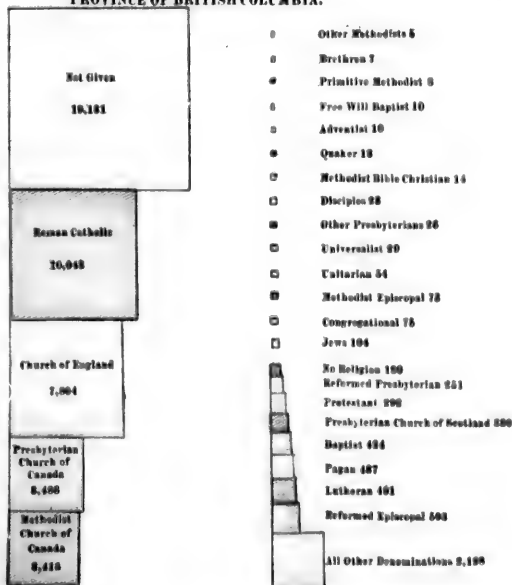




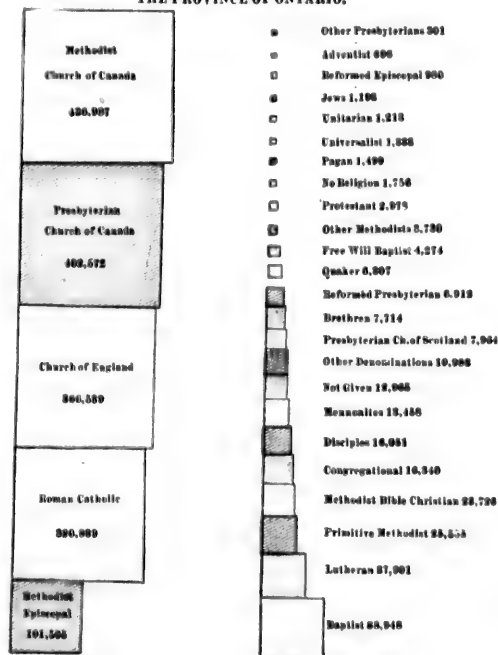
COMPARISONS OF THE RELIGIONS OF THE PROVINCE OF PRINCE EDWARD ISLAND.



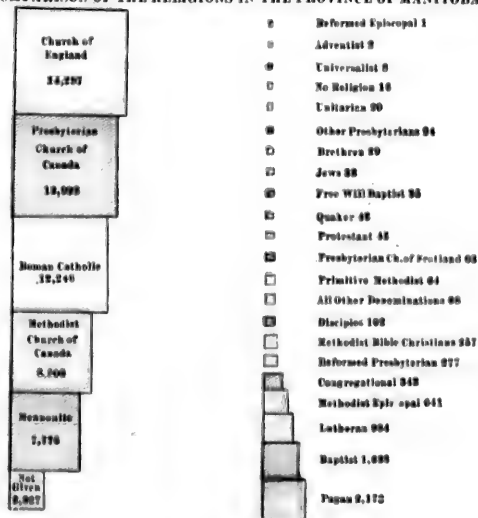
COMPARISON OF THE RELIGIONS OF THE PROVINCE OF BRITISH COLUMBIA.

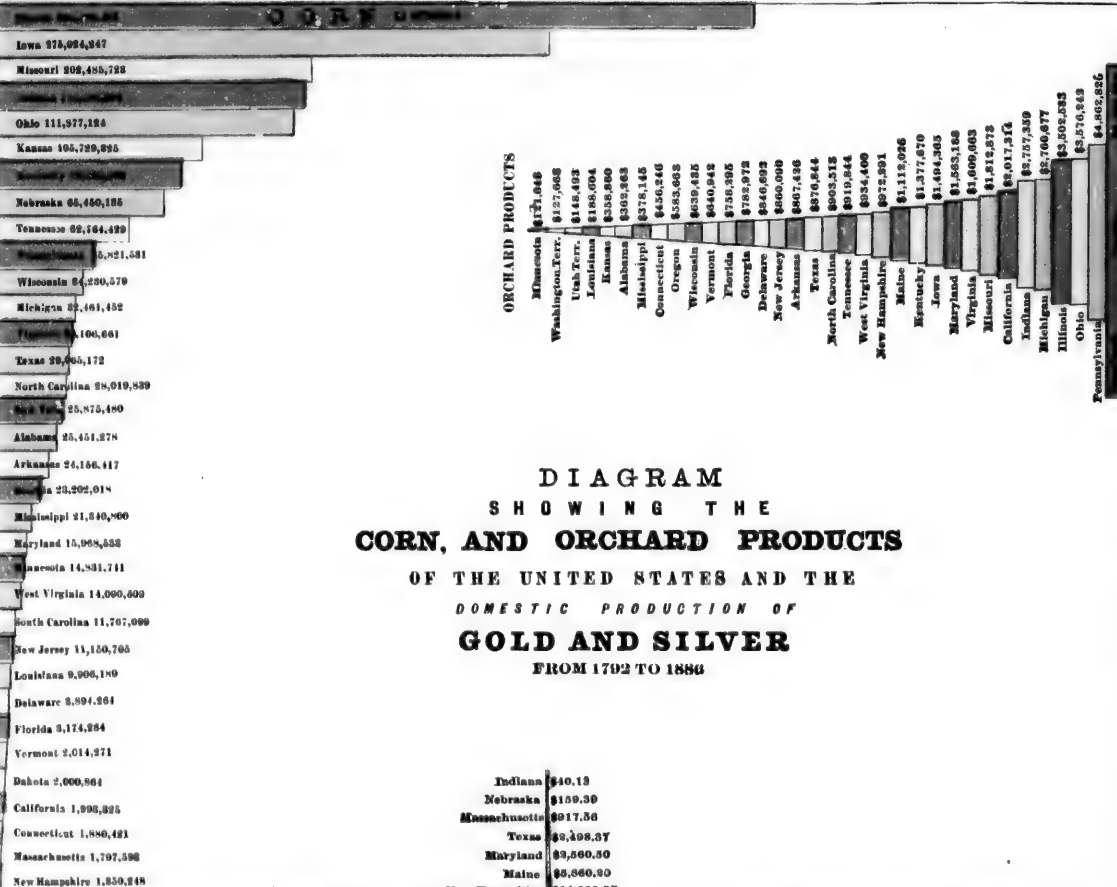


COMPARISON OF THE RELIGIOUS CREEDS OF THE PROVINCE OF ONTARIO.



COMPARISON OF THE RELIGIONS IN THE PROVINCE OF MANITOBA.





**DIAGRAM
SHOWING THE
CORN, AND ORCHARD PRODUCTS
OF THE UNITED STATES AND THE
DOMESTIC PRODUCTION OF
GOLD AND SILVER
FROM 1792 TO 1886**

WHERE OUR GOLD COMES FROM.

California	\$789,788,449.00
Refined Bullion	\$357,048,593.59
Montana	\$54,345,342.55
Colorado	\$44,431,821.87
Idaho	\$20,084,498.87
Nevada	\$20,497,510.25
Dakota	\$20,339,531.70
Oregon	\$17,838,034.76
Parted from silver	\$10,409,768.48
North Carolina	\$10,931,032.38
Various sources	\$10,678,000.26
Contained in silver	\$9,339,368.97
Georgia	\$8,156,184.83
Arizona	\$3,451,186.51
New Mexico	\$1,950,546.38
Virginia	\$1,710,641.48
South Carolina	\$1,515,030.63

Wyoming produced \$68,307.00, and Utah \$99,867.38. The gold product of states and territories not included in the above column is much less in each case and ranges from \$111.50 (Washington Territory) to \$40.81 (Indiana).

WHERE OUR SILVER COMES FROM.

Refined bullion	\$113,880,766.01
Nevada	\$59,095,659.49
Various sources	
Colorado	\$32,560,463.18
Utah	\$17,687,386.38
Arizona	\$15,343,548.00
Montana	\$10,071,448.14
Parted from gold	\$7,075,851.68
New Mexico	\$4,914,811.16
California	\$3,070,566.84
Michigan	\$3,559,110.80
Idaho	\$1,330,385.07
Contained in gold	\$520,384.70
Dakota	\$337,300.97
Oregon	\$51,160.05
North Carolina	\$48,013.79
Wyoming	\$11,856.77

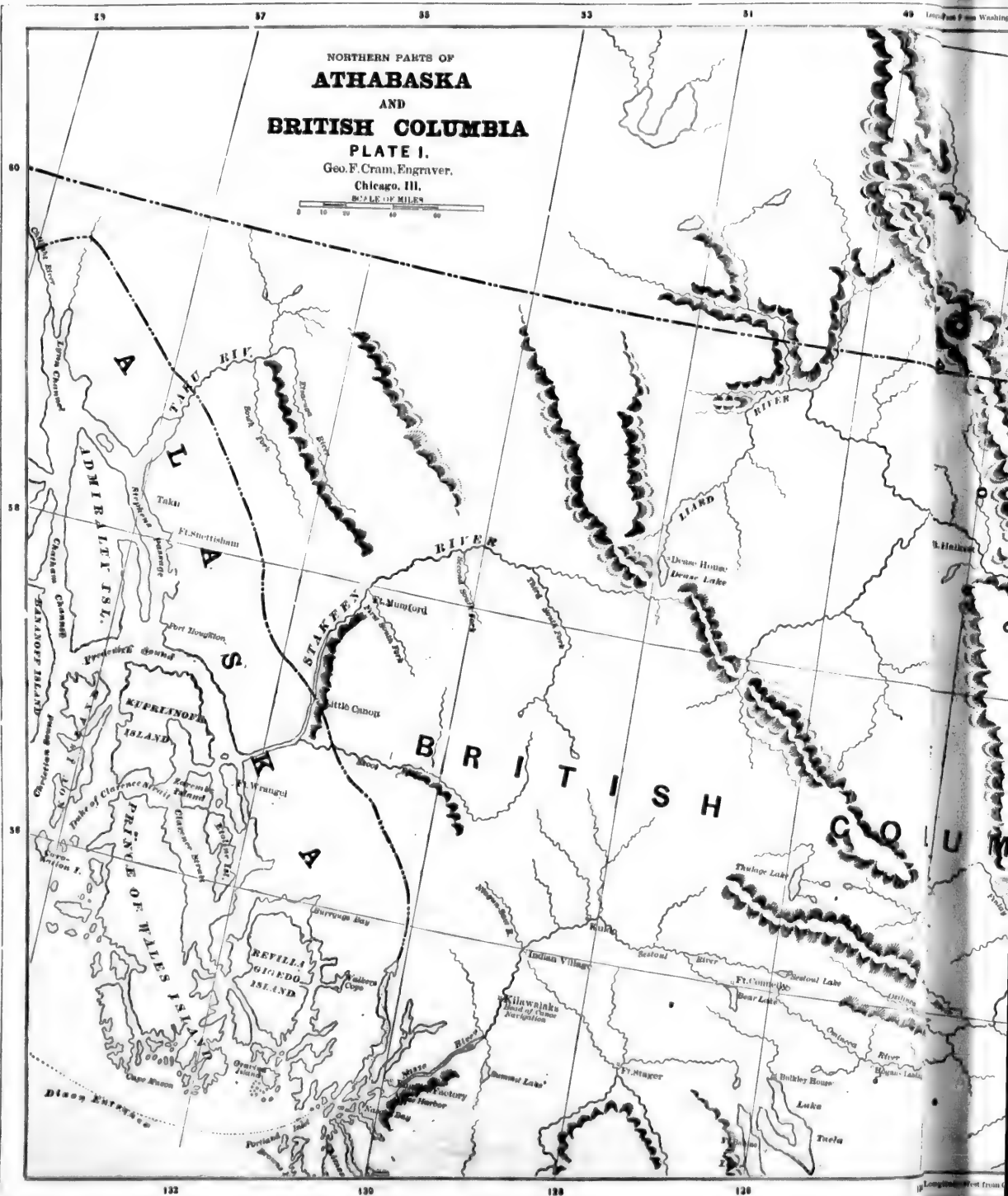
These produced \$1,000.00, Georgia, \$131.00 and Alaska, \$100.00. The silver production of states and territories not included in the above column is much less in each case, and ranges from \$27.00 (Washington Territory) to \$0.00 (Indiana).

Refined bullion **\$1,138,880,766.01** **\$1,138,880,766.01**

NORTHERN PARTS OF
ATHABASKA
AND
BRITISH COLUMBIA
PLATE I.

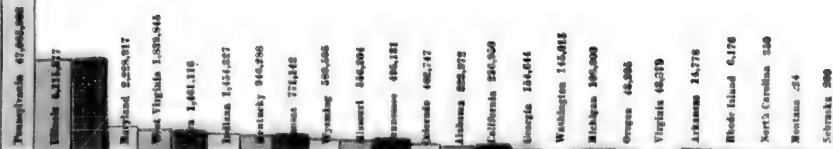
Geo. F. Cram, Engraver,
Chicago, Ill.

SCALE OF MILES
0 10 20 30 40 50





ANNUAL PRODUCTION OF COAL IN THE UNITED STATES (in tons)



ANNUAL PRODUCTION OF COAL IN VARIOUS COUNTRIES (in tons)

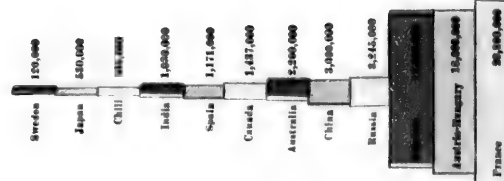
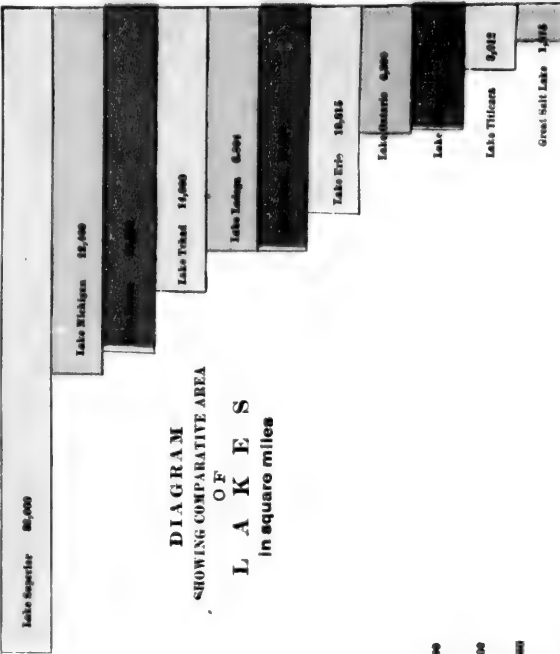
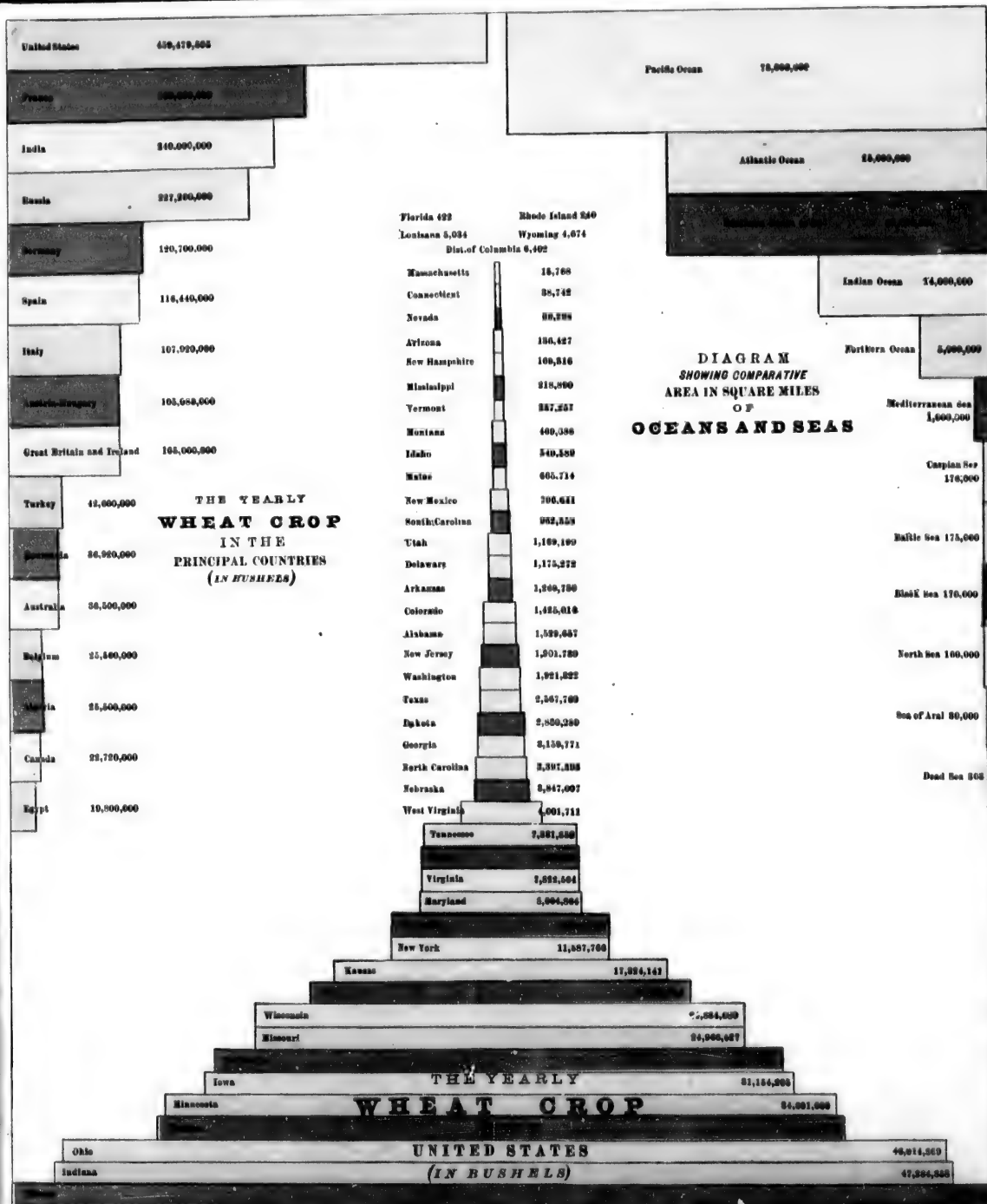
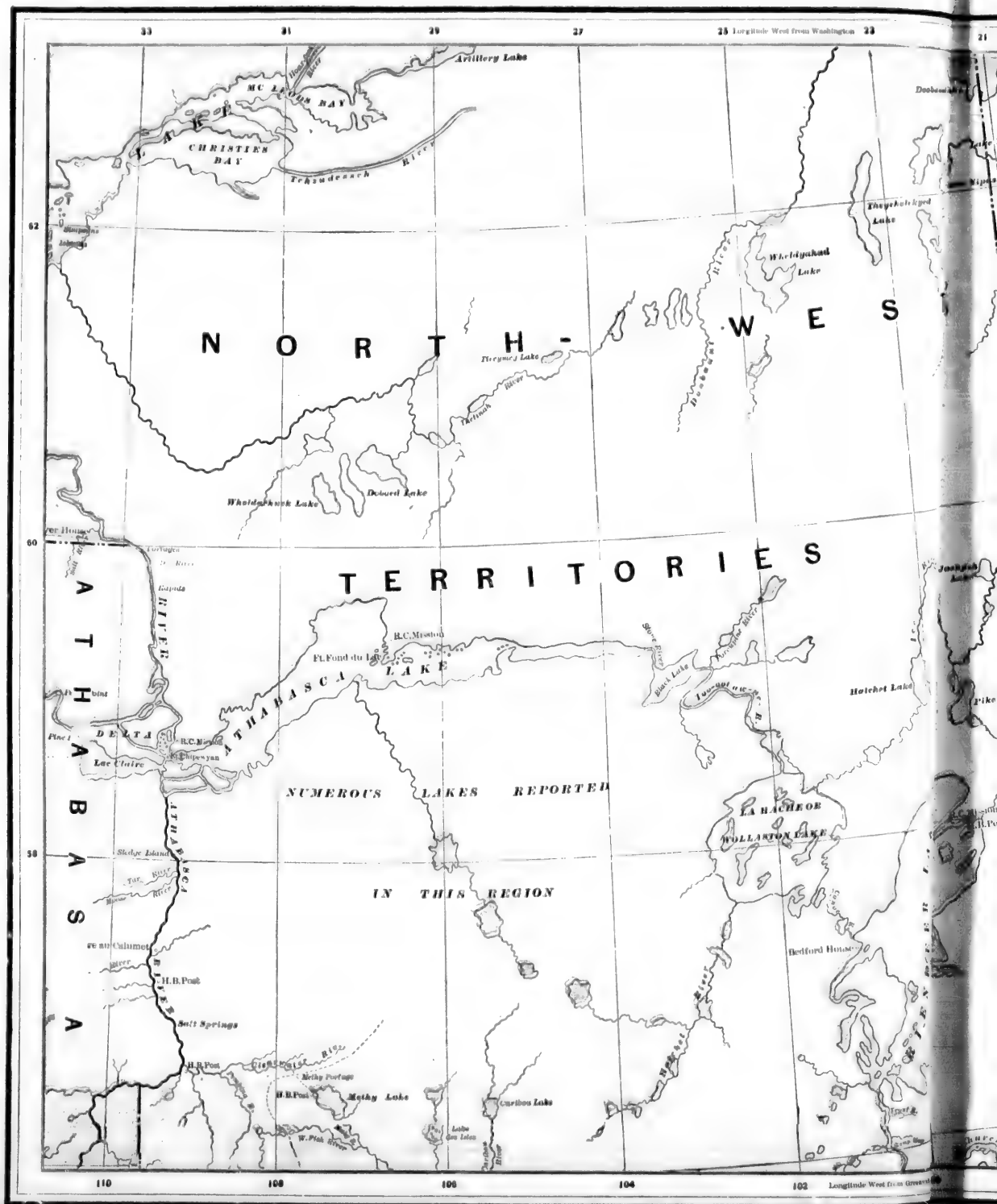


DIAGRAM SHOWING COMPARATIVE AREA OF LAKES in square miles

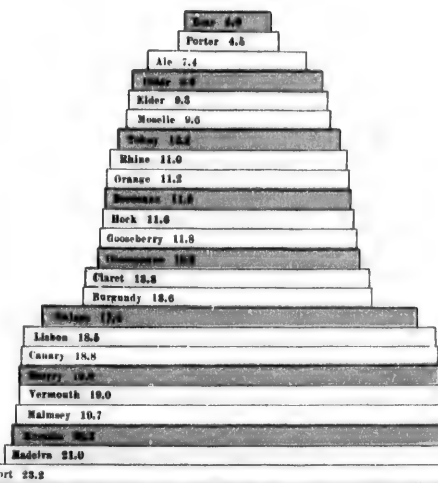
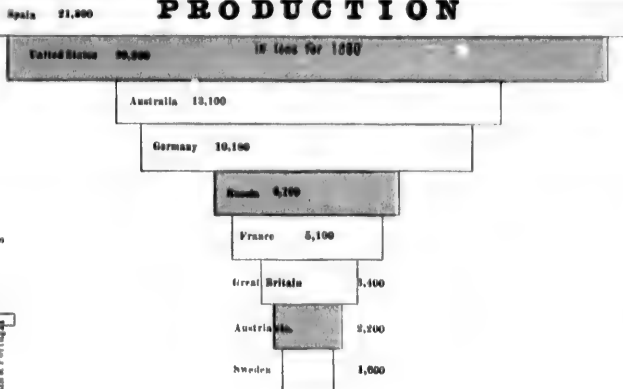








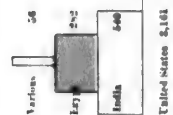
**COPPER
PRODUCTION**



Old 51.6
Brandy 53.4
Whiskey Irish 52.9
Whiskey Scotch 51.3

CONTENTS

PRODUCTION
In Million Lbs.
For 1880



CONSUMPTION
In Million Lbs.
for 1980

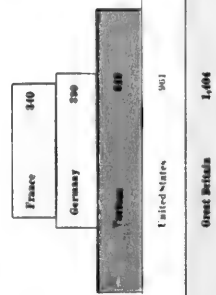
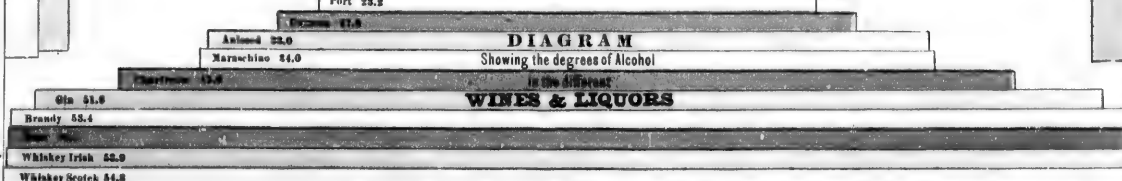


DIAGRAM
Showing the degrees of Alcohol
in the different
WINES & LIQUORS



Germany 600

SUGAR PRODUCTION

Cuba 280

America 600

France 590

British Colonies 540

Egypt, etc. 290

Hawaii 240

Java 190

Brazil 190

Manilla 180

Holland, etc. 110

French Colonies 100

United States 90

Great Britain 187 One per Cent. 10

Various Countries 114

United States 72

Europe 37

Australia 14

TEAS

CONSUMPTION
(In Million Lbs.)

PRODUCTION
(In Million Lbs.)

China 290 Value \$45 Millions

India 50

Japan 25

Peru 10

Java 7

DRINK OF ALL NATIONS (In Millions of Gallons)

Denmark Beer 85 Wine 1

Holland Beer 85 Wine 7

Portugal Wine 60 Beer 1

Sweden & Norway Beer 85 Wine 2

Belgium Beer 170 Wine 6

Colonies, etc. Wine 100 Beer 81 Spirits 20

Spain Wine 990 Beer 3

Hawaii Spirits 145 Beer 80 Wine 80

Italy Wine 480 Beer 80 Spirits 10

United States Beer 600 Spirits 75 Wine 50

Austria Wine 500 Beer 245

France Wine 700 Beer 190 Spirits 94

Germany Beer 600

United Kingdom Beer 1007

Value \$13 Millions

Manilla, etc. 25

Africa 56

West India 25

Ceylon 10

Java 25

Brazil 110

COFFEE PRODUCTION (In Thousands of Tons)

CONSUMPTION OF COFFEE (In Thousands of Tons)

India 14

United Kingdom 14

Holland 10

Brazil 25

Colonies, etc. 20

Belgium and Holland 40

France 65

United States 105

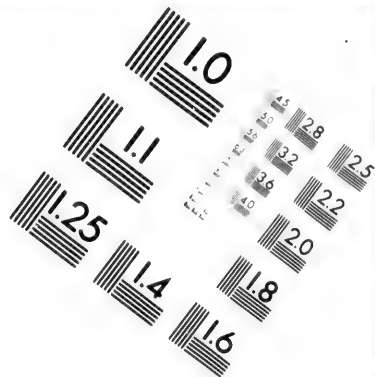
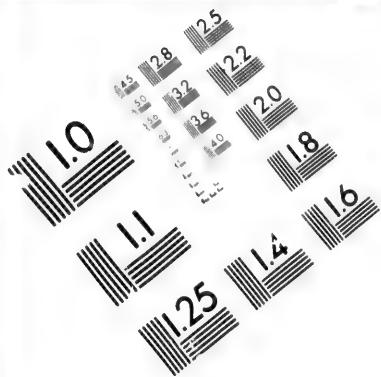
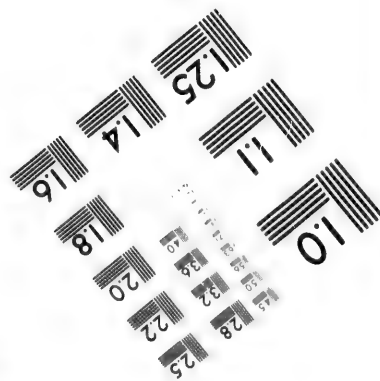
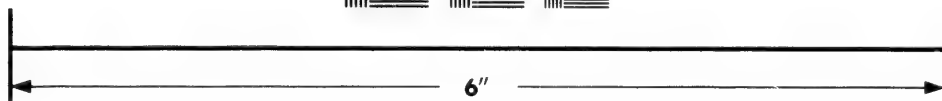
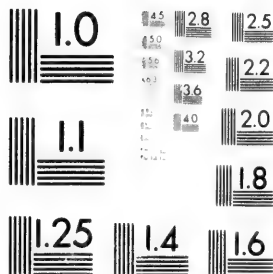


IMAGE EVALUATION TEST TARGET (MT-3)

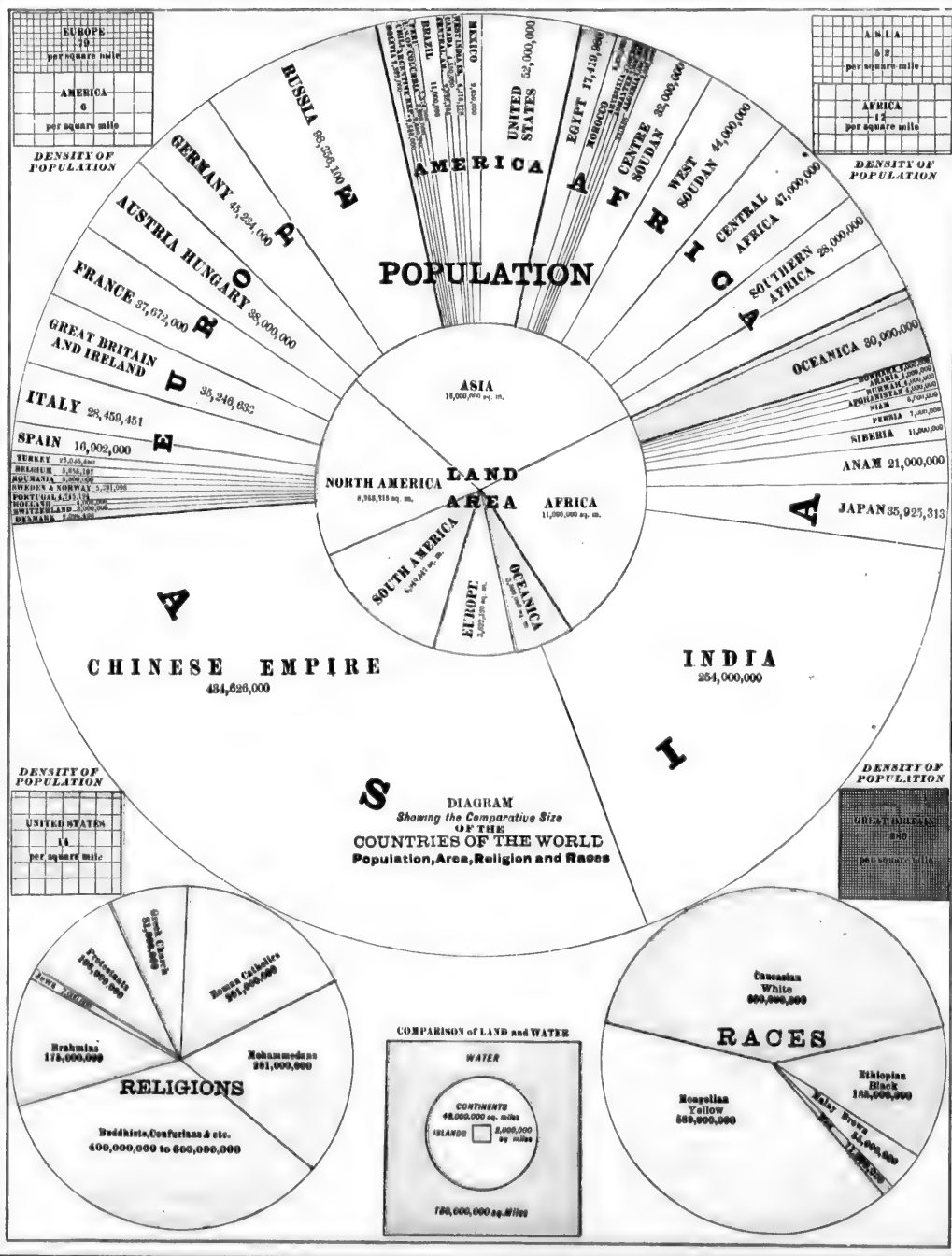


Photographic
Sciences
Corporation

23 WEST MAIN STREET
WEBSTER, N.Y. 14580
(716) 872-4503

45 28 25
32 22
20

10



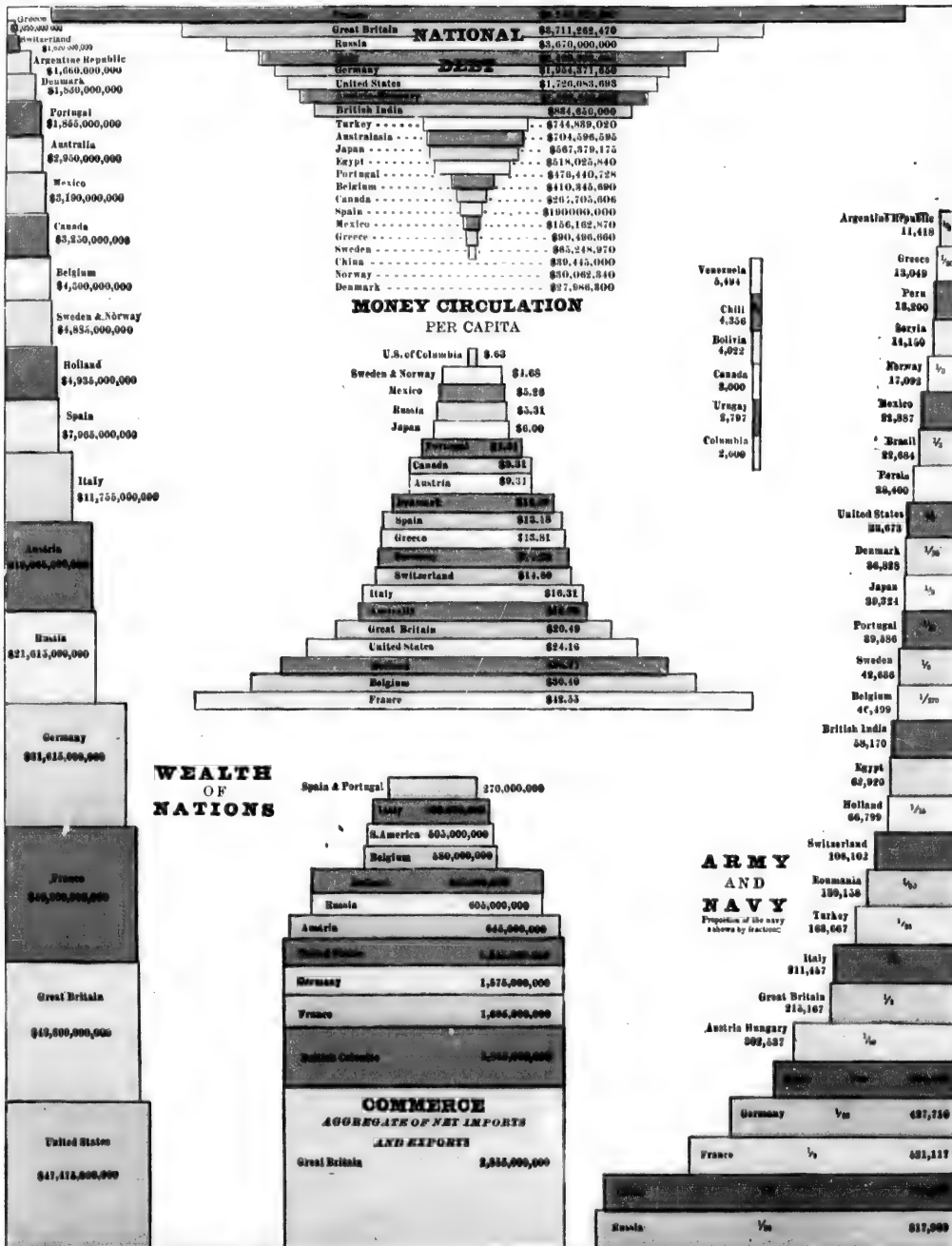
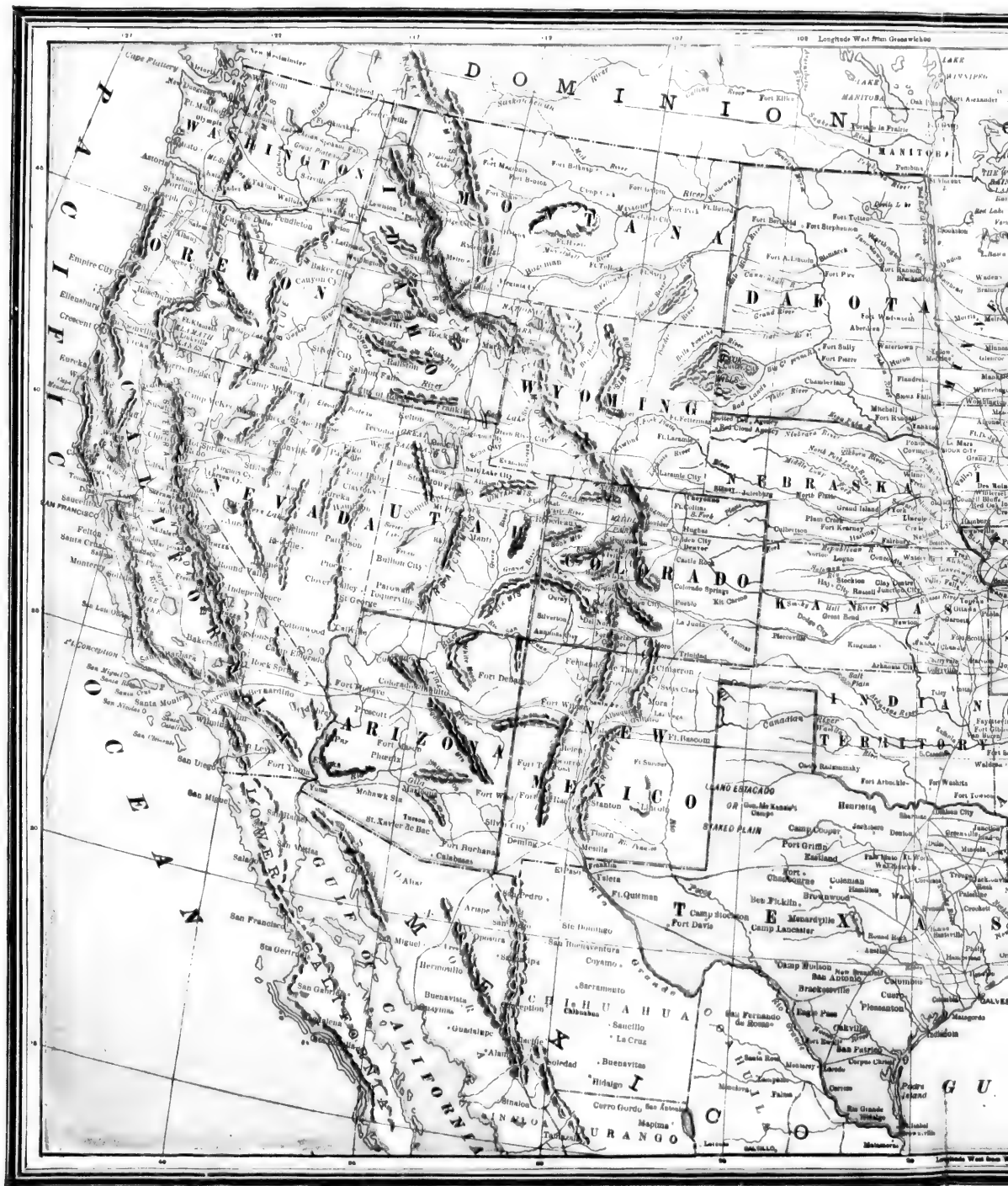


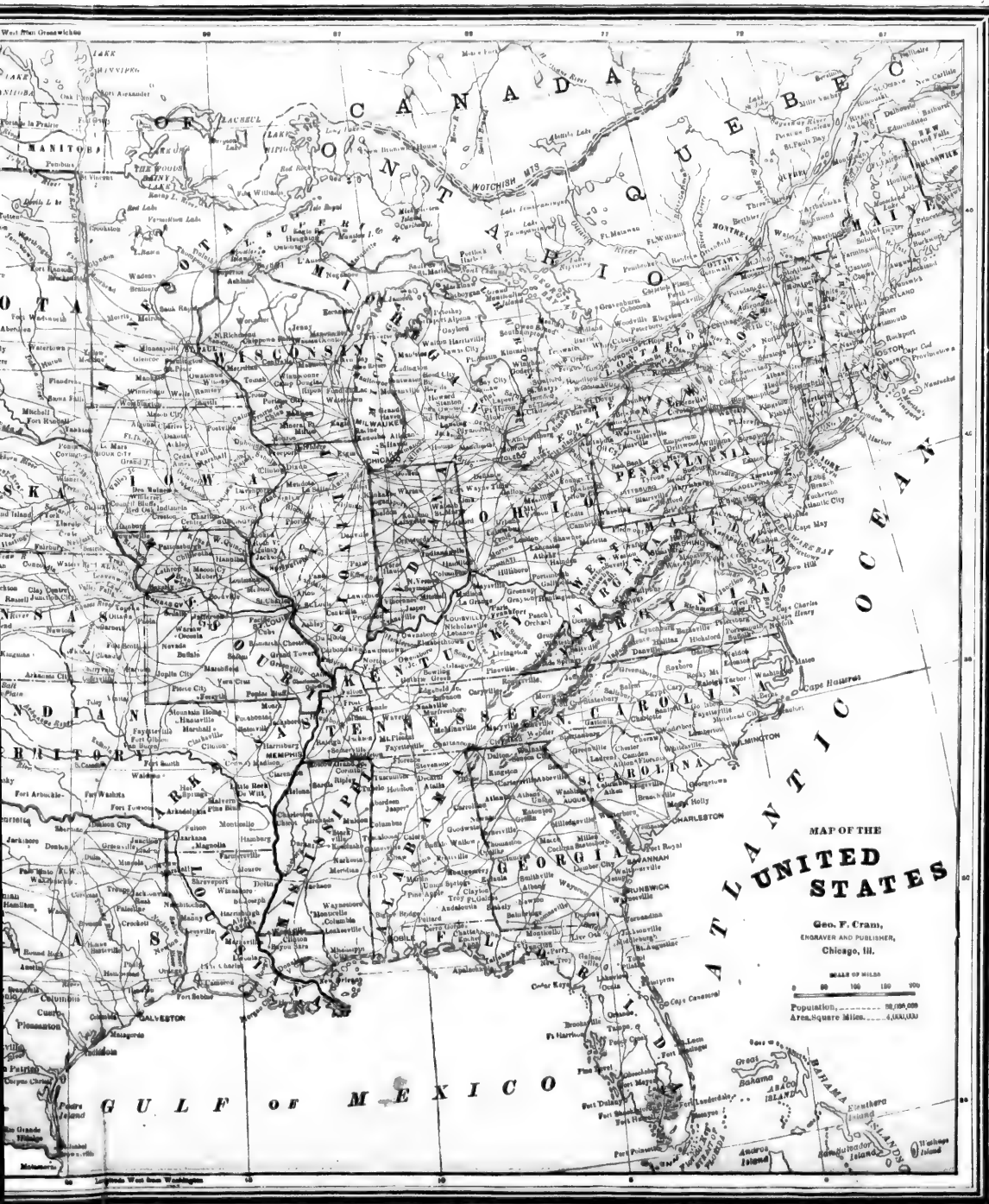
Photo: Shutterfly.com

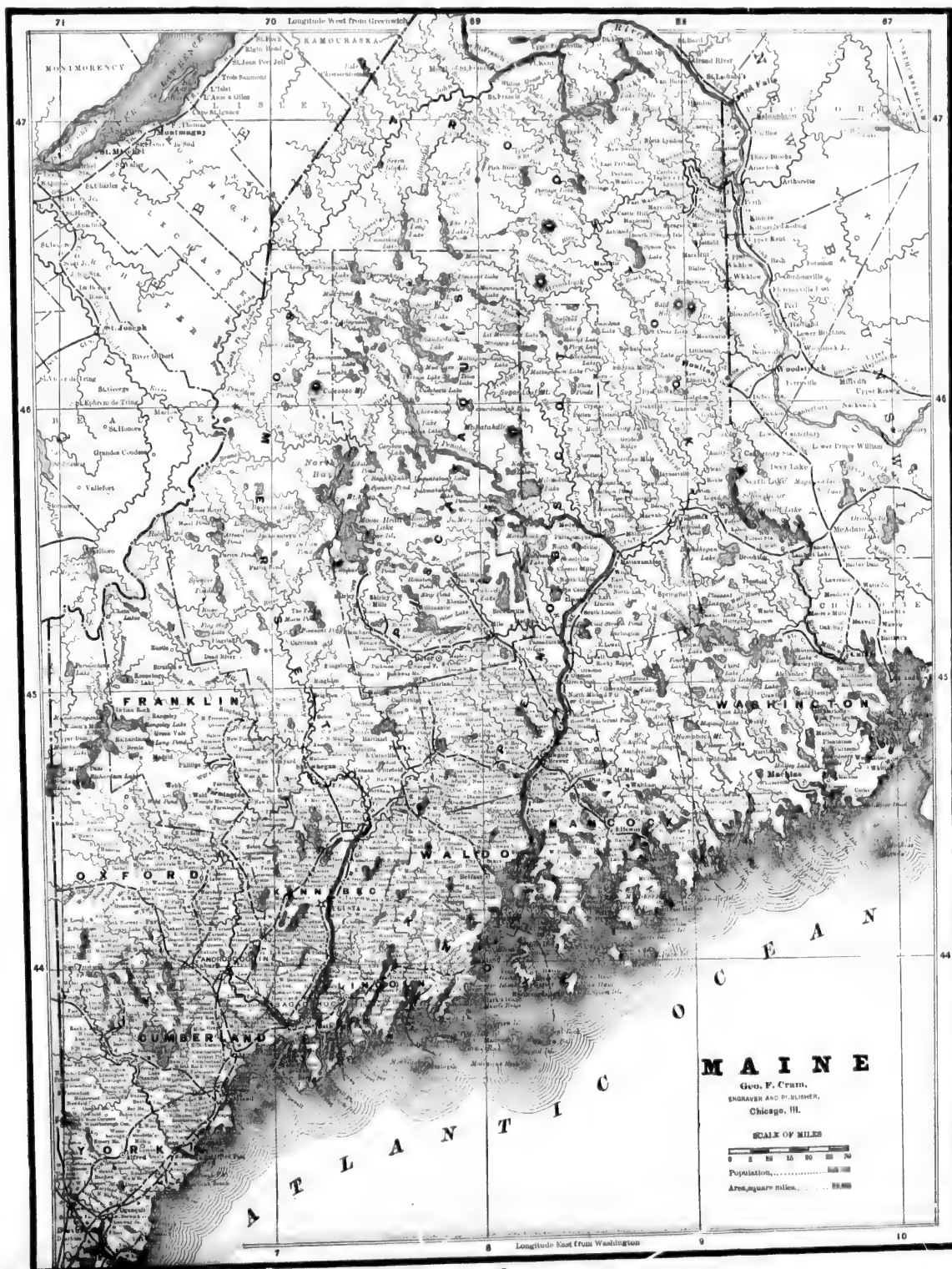
HETERO-CENTRAL STANDARD TIME			CENTRAL STANDARD TIME			MOUNTAIN STANDARD TIME			PACIFIC STANDARD TIME		
At	10 mi. faster than	Solar Time.	At	21 mi. faster than	Solar Time.	At	6 mi. faster than	Solar Time.	At	7 mi. faster than	Solar Time.
At Charleston, Prince Edward	10 "	faster	At Houston, Tex.	19 "	faster	At El Paso, N. Mex.	35 "	faster	At Los Angeles, Cal.	10 "	faster
" " " "	10 "	faster	" " Indianapolis, Ind.	16 "	faster	" " St. Paul, Minn.	36 "	faster	" " San Francisco, Cal.	11 "	faster
" " " "	10 "	faster	" " Jacksonville, Fla.	15 "	faster	" " Savannah, Ga.	35 "	slower	" " Seattle, Wash.	12 "	faster
" " " "	10 "	faster	" " Quebec, Que.	14 "	faster	" " Silver Spring, La.	31 "	faster	" " Portland, Ore.	10 "	faster
" " " "	10 "	faster	" " St. Louis, Mo.	13 "	faster	" " St. Paul, Minn.	36 "	faster	" " Portland, Ore.	10 "	faster
" " " "	10 "	faster	" " Knoxville, Tenn.	24 "	slower	" " St. Paul, Minn.	36 "	faster	" " Portland, Ore.	10 "	faster
" " " "	10 "	faster	" " Louisville, Ky.	18 "	slower	" " St. Paul, Minn.	36 "	faster	" " Portland, Ore.	10 "	faster
" " " "	10 "	faster	" " Little Rock, Ark.	9 "	faster	" " St. Paul, Minn.	36 "	faster	" " Portland, Ore.	10 "	faster
" " " "	10 "	faster	" " Memphis, Tenn.	No change	No change	" " St. Paul, Minn.	36 "	faster	" " Portland, Ore.	10 "	faster
" " " "	10 "	faster	" " Memphis, Tenn.	No change	No change	" " St. Paul, Minn.	36 "	faster	" " Portland, Ore.	10 "	faster
" " " "	10 "	faster	" " Memphis, Tenn.	No change	No change	" " St. Paul, Minn.	36 "	faster	" " Portland, Ore.	10 "	faster
" " " "	10 "	faster	" " Memphis, Tenn.	No change	No change	" " St. Paul, Minn.	36 "	faster	" " Portland, Ore.	10 "	faster
" " " "	10 "	faster	" " Memphis, Tenn.	No change	No change	" " St. Paul, Minn.	36 "	faster	" " Portland, Ore.	10 "	faster
" " " "	10 "	faster	" " Memphis, Tenn.	No change	No change	" " St. Paul, Minn.	36 "	faster	" " Portland, Ore.	10 "	faster
" " " "	10 "	faster	" " Memphis, Tenn.	No change	No change	" " St. Paul, Minn.	36 "	faster	" " Portland, Ore.	10 "	faster
" " " "	10 "	faster	" " Memphis, Tenn.	No change	No change	" " St. Paul, Minn.	36 "	faster	" " Portland, Ore.	10 "	faster
" " " "	10 "	faster	" " Memphis, Tenn.	No change	No change	" " St. Paul, Minn.	36 "	faster	" " Portland, Ore.	10 "	faster
" " " "	10 "	faster	" " Memphis, Tenn.	No change	No change	" " St. Paul, Minn.	36 "	faster	" " Portland, Ore.	10 "	faster
" " " "	10 "	faster	" " Memphis, Tenn.	No change	No change	" " St. Paul, Minn.	36 "	faster	" " Portland, Ore.	10 "	faster
" " " "	10 "	faster	" " Memphis, Tenn.	No change	No change	" " St. Paul, Minn.	36 "	faster	" " Portland, Ore.	10 "	faster
" " " "	10 "	faster	" " Memphis, Tenn.	No change	No change	" " St. Paul, Minn.	36 "	faster	" " Portland, Ore.	10 "	faster
" " " "	10 "	faster	" " Memphis, Tenn.	No change	No change	" " St. Paul, Minn.	36 "	faster	" " Portland, Ore.	10 "	faster
" " " "	10 "	faster	" " Memphis, Tenn.	No change	No change	" " St. Paul, Minn.	36 "	faster	" " Portland, Ore.	10 "	faster
" " " "	10 "	faster	" " Memphis, Tenn.	No change	No change	" " St. Paul, Minn.	36 "	faster	" " Portland, Ore.	10 "	faster
" " " "	10 "	faster	" " Memphis, Tenn.	No change	No change	" " St. Paul, Minn.	36 "	faster	" " Portland, Ore.	10 "	faster
" " " "	10 "	faster	" " Memphis, Tenn.	No change	No change	" " St. Paul, Minn.	36 "	faster	" " Portland, Ore.	10 "	faster
" " " "	10 "	faster	" " Memphis, Tenn.	No change	No change	" " St. Paul, Minn.	36 "	faster	" " Portland, Ore.	10 "	faster
" " " "	10 "	faster	" " Memphis, Tenn.	No change	No change	" " St. Paul, Minn.	36 "	faster	" " Portland, Ore.	10 "	faster
" " " "	10 "	faster	" " Memphis, Tenn.	No change	No change	" " St. Paul, Minn.	36 "	faster	" " Portland, Ore.	10 "	faster
" " " "	10 "	faster	" " Memphis, Tenn.	No change	No change	" " St. Paul, Minn.	36 "	faster	" " Portland, Ore.	10 "	faster
" " " "	10 "	faster	" " Memphis, Tenn.	No change	No change	" " St. Paul, Minn.	36 "	faster	" " Portland, Ore.	10 "	faster
" " " "	10 "	faster	" " Memphis, Tenn.	No change	No change	" " St. Paul, Minn.	36 "	faster	" " Portland, Ore.	10 "	faster
" " " "	10 "	faster	" " Memphis, Tenn.	No change	No change	" " St. Paul, Minn.	36 "	faster	" " Portland, Ore.	10 "	faster
" " " "	10 "	faster	" " Memphis, Tenn.	No change	No change	" " St. Paul, Minn.	36 "	faster	" " Portland, Ore.	10 "	faster
" " " "	10 "	faster	" " Memphis, Tenn.	No change	No change	" " St. Paul, Minn.	36 "	faster	" " Portland, Ore.	10 "	faster
" " " "	10 "	faster	" " Memphis, Tenn.	No change	No change	" " St. Paul, Minn.	36 "	faster	" " Portland, Ore.	10 "	faster
" " " "	10 "	faster	" " Memphis, Tenn.	No change	No change	" " St. Paul, Minn.	36 "	faster	" " Portland, Ore.	10 "	faster
" " " "	10 "	faster	" " Memphis, Tenn.	No change	No change	" " St. Paul, Minn.	36 "	faster	" " Portland, Ore.	10 "	faster
" " " "	10 "	faster	" " Memphis, Tenn.	No change	No change	" " St. Paul, Minn.	36 "	faster	" " Portland, Ore.	10 "	faster
" " " "	10 "	faster	" " Memphis, Tenn.	No change	No change	" " St. Paul, Minn.	36 "	faster	" " Portland, Ore.	10 "	faster
" " " "	10 "	faster	" " Memphis, Tenn.	No change	No change	" " St. Paul, Minn.	36 "	faster	" " Portland, Ore.	10 "	faster
" " " "	10 "	faster	" " Memphis, Tenn.	No change	No change	" " St. Paul, Minn.	36 "	faster	" " Portland, Ore.	10 "	faster
" " " "	10 "	faster	" " Memphis, Tenn.	No change	No change	" " St. Paul, Minn.	36 "	faster	" " Portland, Ore.	10 "	faster
" " " "	10 "	faster	" " Memphis, Tenn.	No change	No change	" " St. Paul, Minn.	36 "	faster	" " Portland, Ore.	10 "	faster
" " " "	10 "	faster	" " Memphis, Tenn.	No change	No change	" " St. Paul, Minn.	36 "	faster	" " Portland, Ore.	10 "	faster
" " " "	10 "	faster	" " Memphis, Tenn.	No change	No change	" " St. Paul, Minn.	36 "	faster	" " Portland, Ore.	10 "	faster
" " " "	10 "	faster	" " Memphis, Tenn.	No change	No change	" " St. Paul, Minn.	36 "	faster	" " Portland, Ore.	10 "	faster
" " " "	10 "	faster	" " Memphis, Tenn.	No change	No change	" " St. Paul, Minn.	36 "	faster	" " Portland, Ore.	10 "	faster
" " " "	10 "	faster	" " Memphis, Tenn.	No change	No change	" " St. Paul, Minn.	36 "	faster	" " Portland, Ore.	10 "	faster
" " " "	10 "	faster	" " Memphis, Tenn.	No change	No change	" " St. Paul, Minn.	36 "	faster	" " Portland, Ore.	10 "	faster
" " " "	10 "	faster	" " Memphis, Tenn.	No change	No change	" " St. Paul, Minn.	36 "	faster	" " Portland, Ore.	10 "	faster
" " " "	10 "	faster	" " Memphis, Tenn.	No change	No change	" " St. Paul, Minn.	36 "	faster	" " Portland, Ore.	10 "	faster
" " " "	10 "	faster	" " Memphis, Tenn.	No change	No change	" " St. Paul, Minn.	36 "	faster			



EXPLANATION.—Central Time is based upon that of the 90th meridian, and is nine minutes slower than Chicago Solar Time. Eastern Time is based upon the 75th meridian, which is one hour faster than Central Time, or four minutes slower than New York City Time. Seasonal Time is based upon the 60th meridian, and is two hours faster than Central Time. The 120th meridian is one hour slower than Central Time, and is two hours slower than Chicago Solar Time. Pacific Time is based upon the 120th meridian, and is two hours slower than Central Time. The 135th meridian is one hour slower than Central Time, and is three hours slower than Chicago Solar Time.



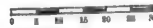




MAINE

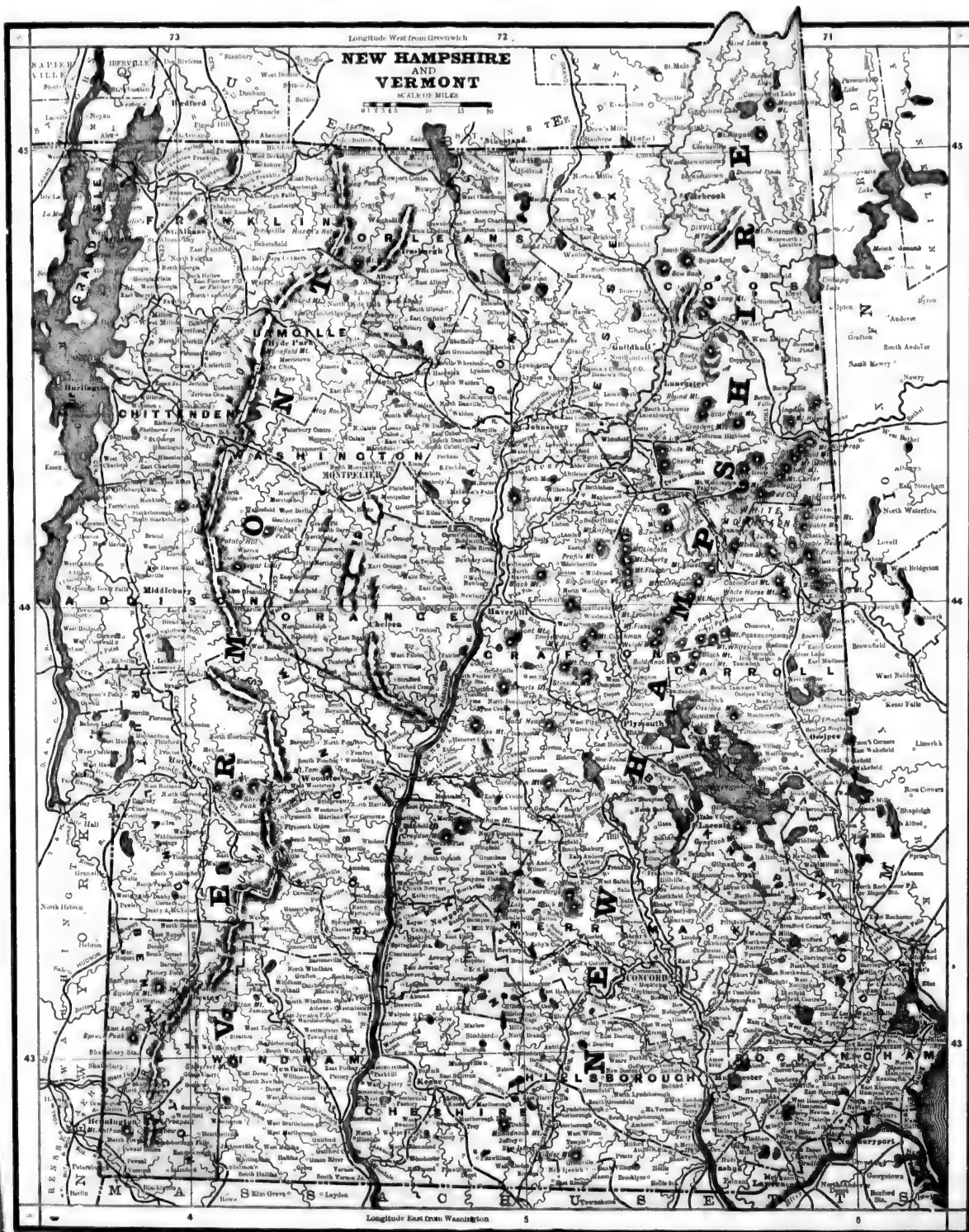
Geo. F. Crain,
ENGRAVER AND PUBLISHER,
Chicago, Ill.

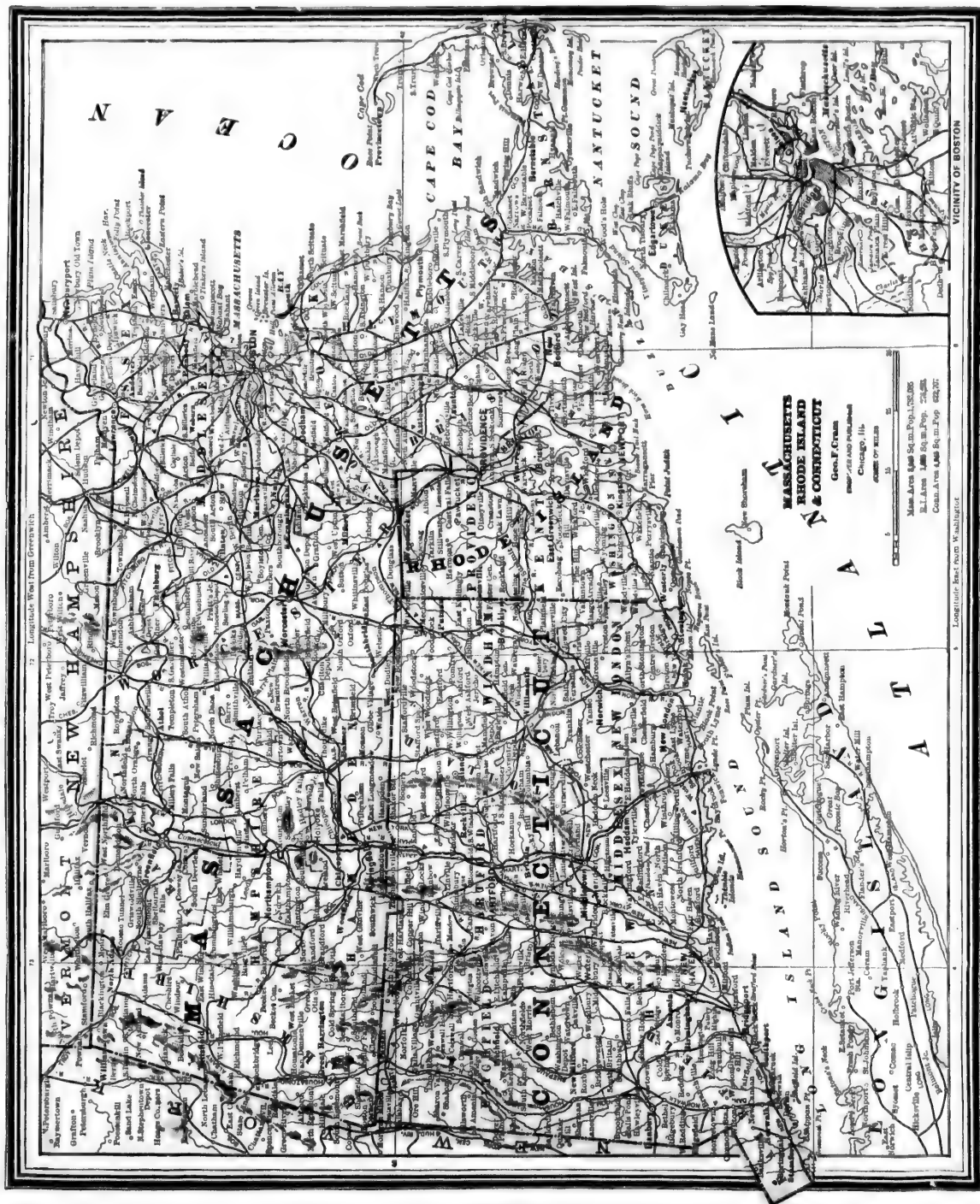
SCALE OF MILES

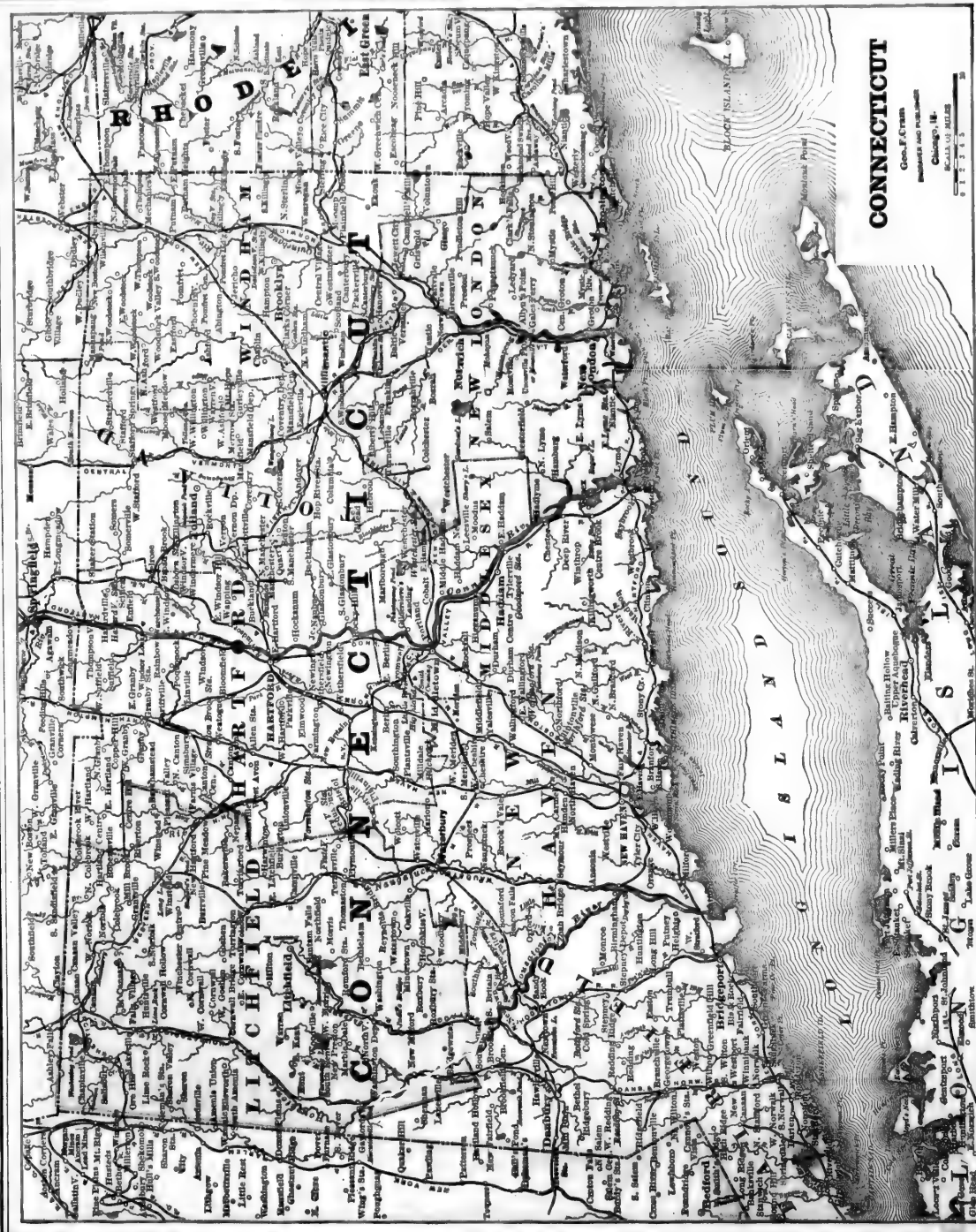


Population,

Area, square miles,

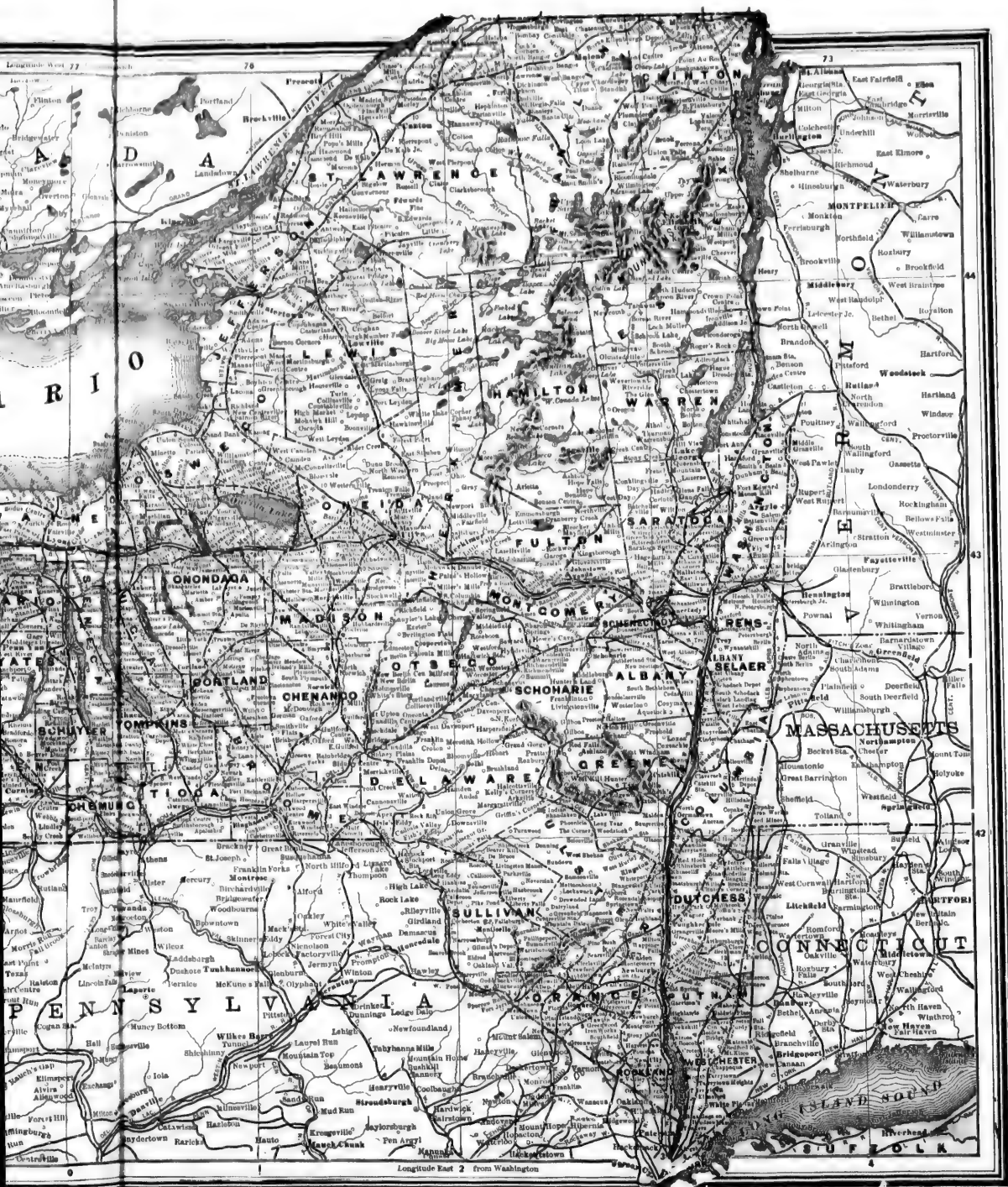


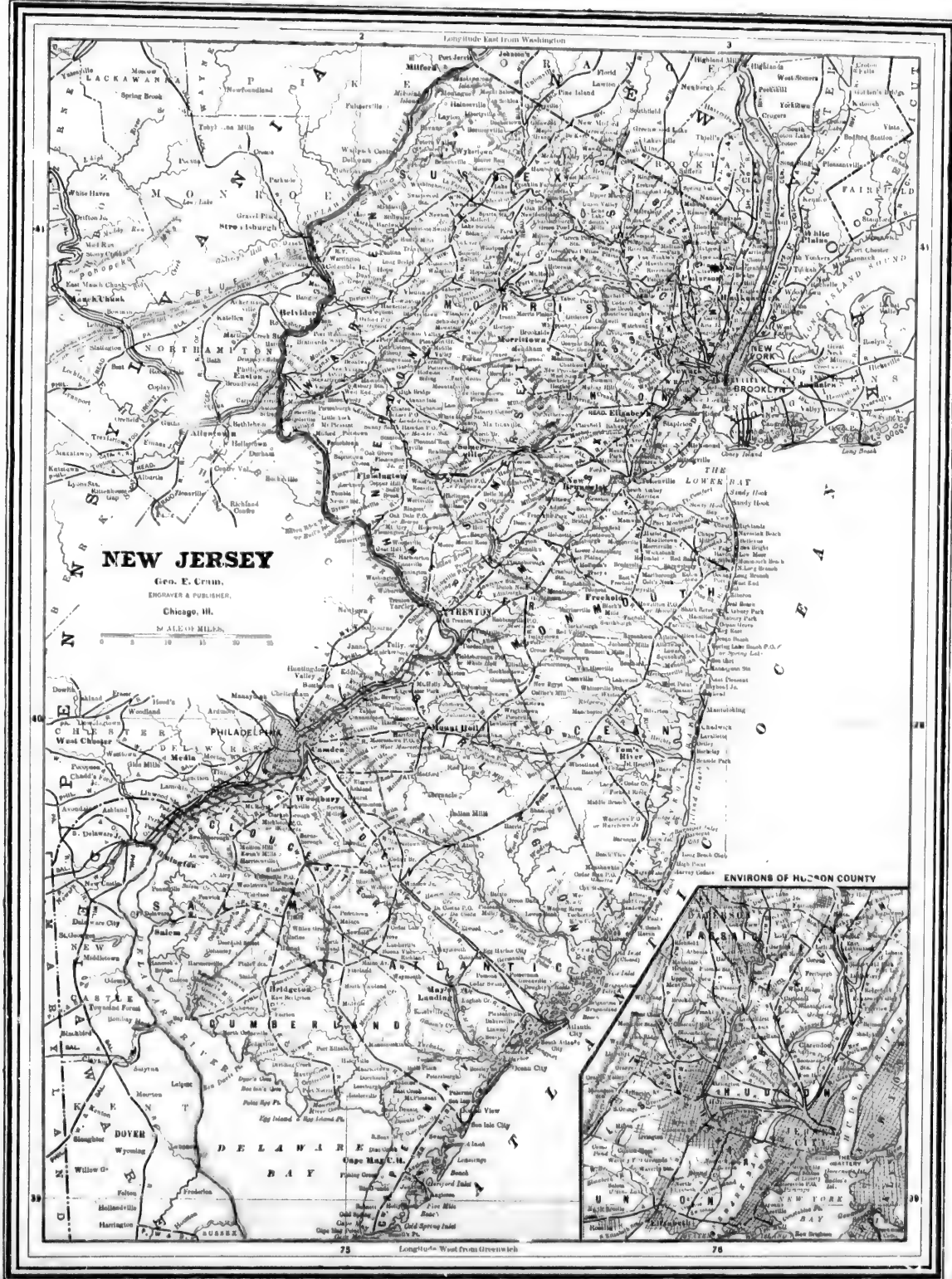




CONNECTICUT

Conn. & Great
 Islands and near-shore
 Chicago, Ill.
 Scale in Miles
 0 1 2 3 4 5



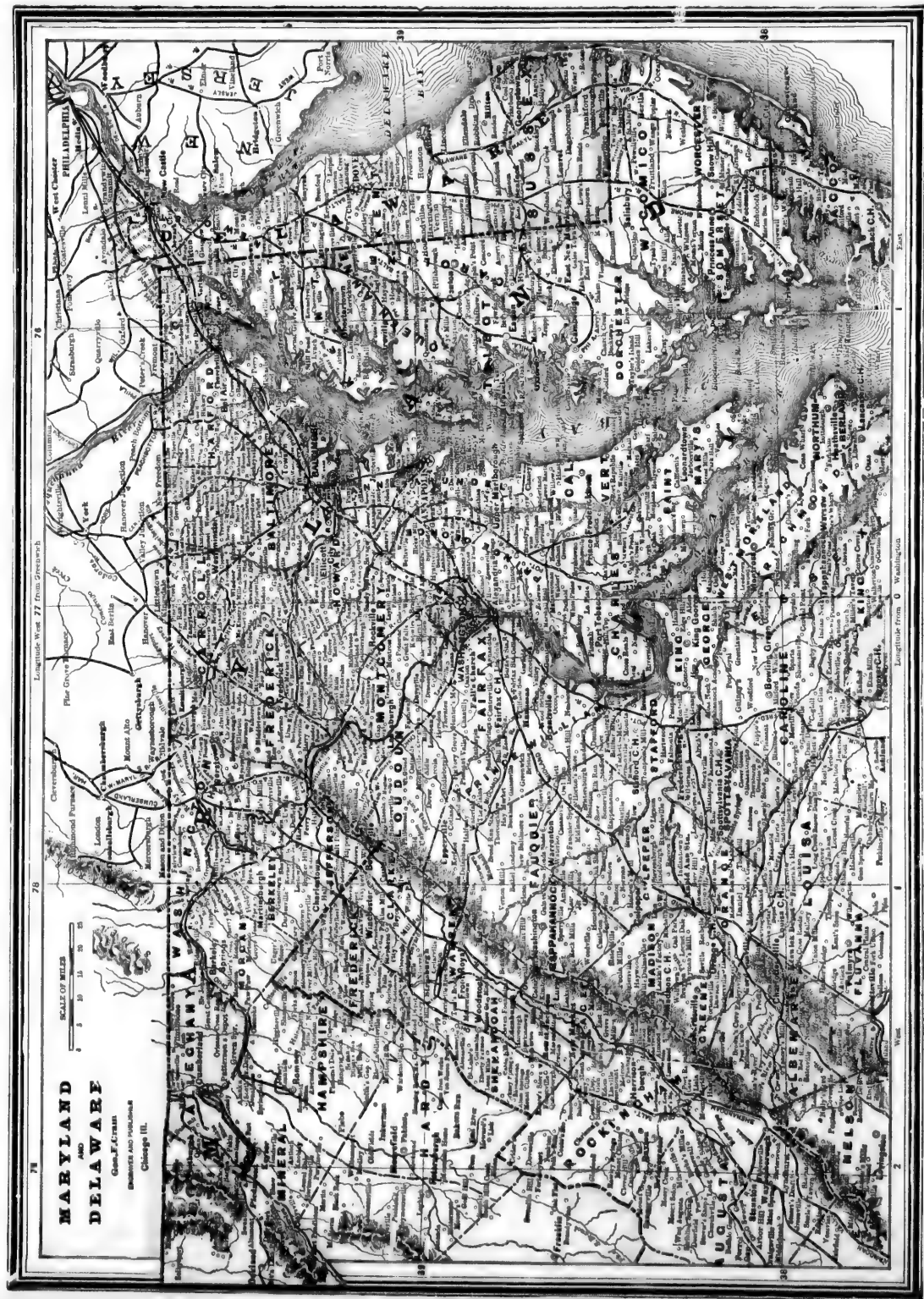


NEW JERSEY

Geo. E. Crum,
Engraver & Publisher,
Chicago, Ill.

Scale of Miles
0 5 10 15 20 25

Environs of Hudson County



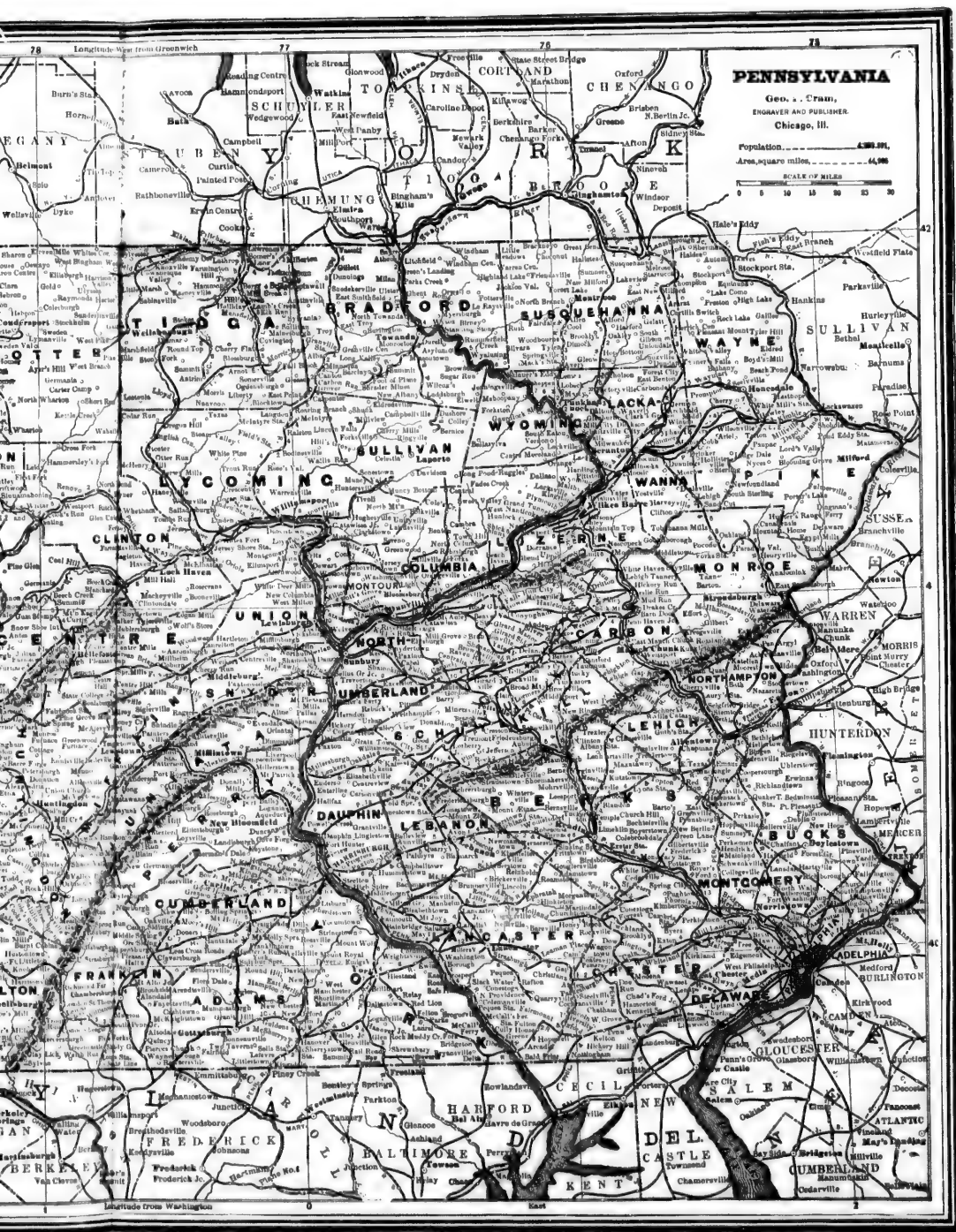
**MARYLAND
AND
DELAWARE**

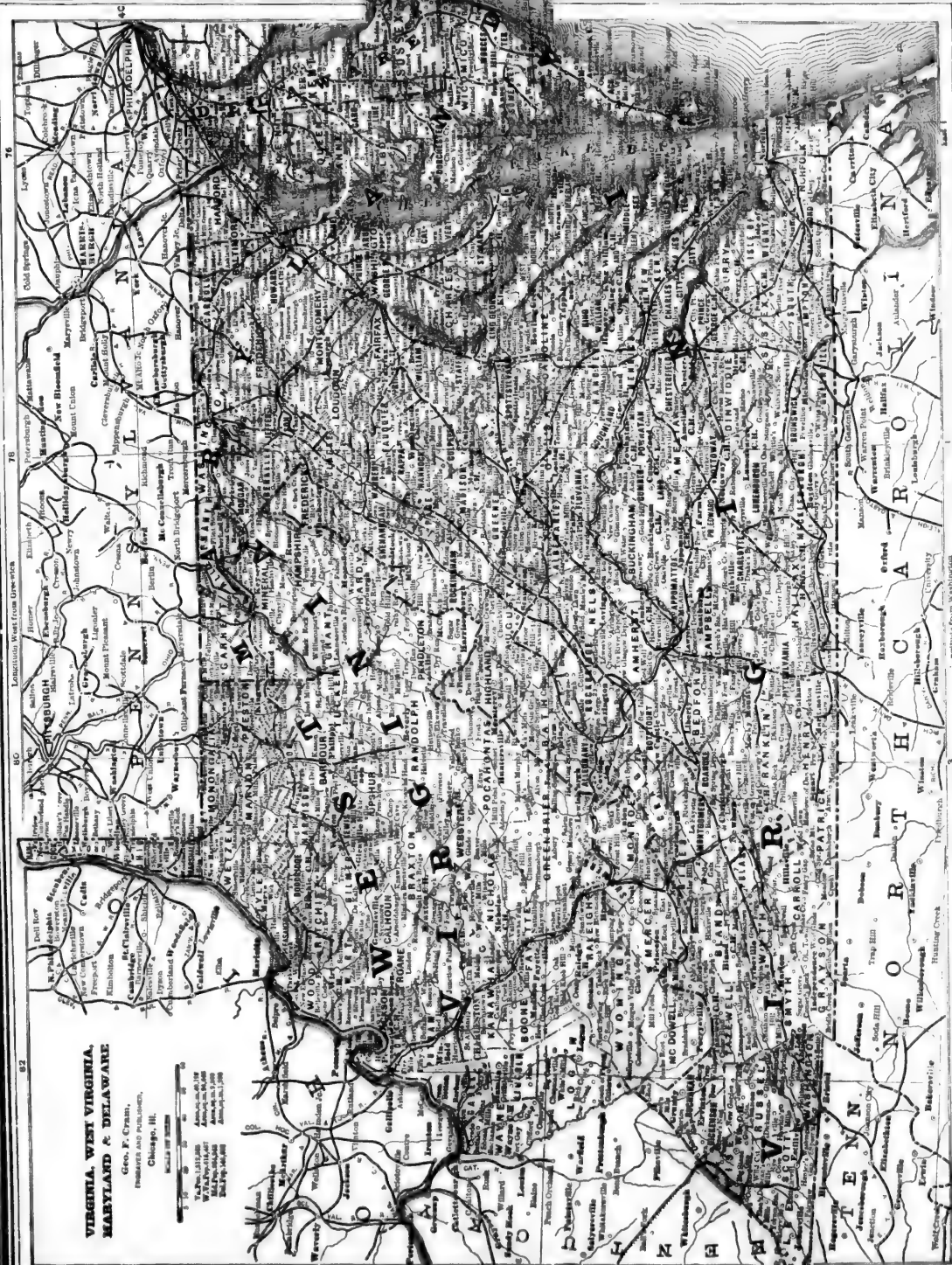
General A. T. Crain
Publishers and Proprietors
Chicago, Ill.

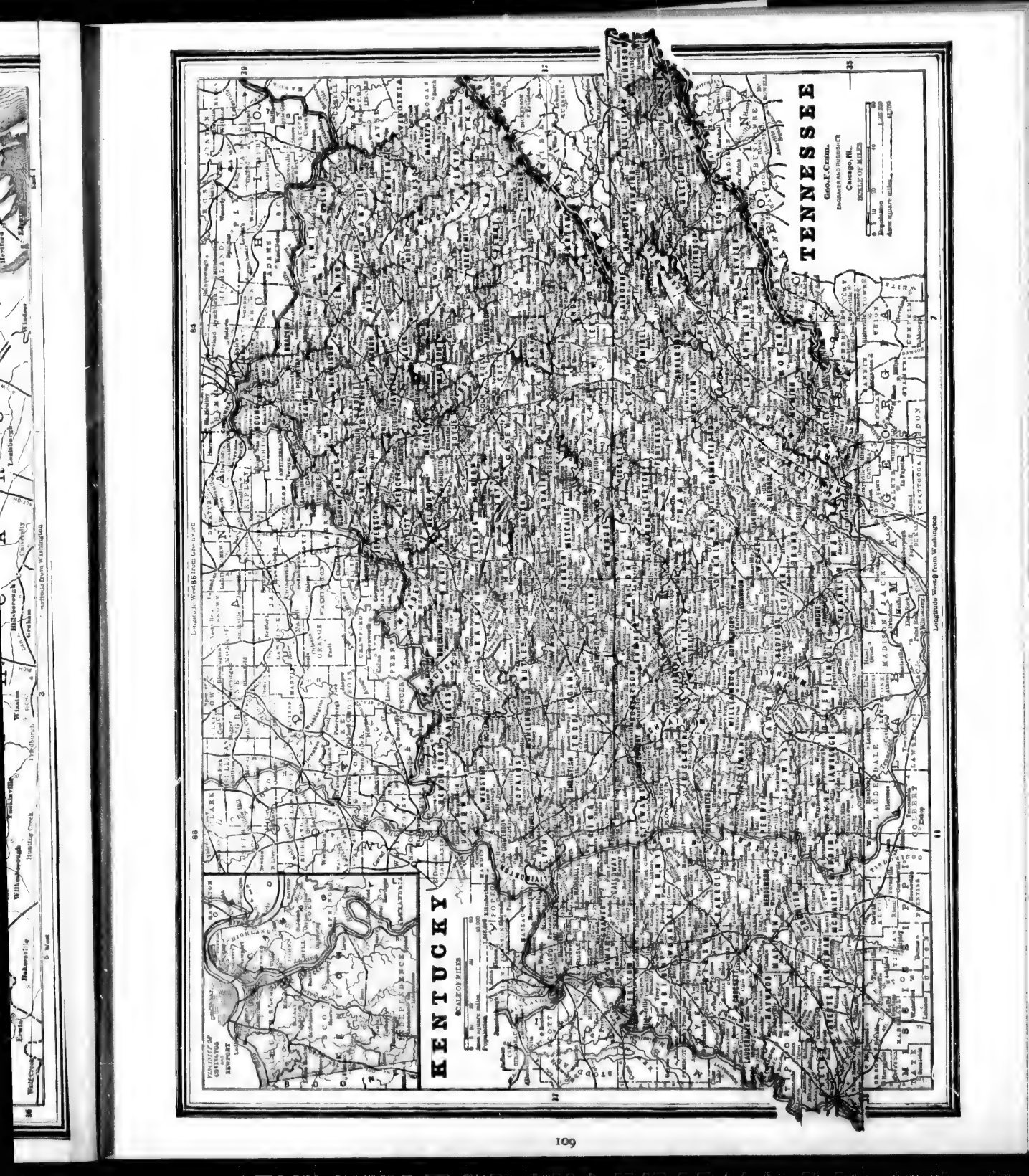
SCALE OF MILES
0 5 10 15 20 25

Longitude West 77 from Greenwich

Longitude from 0 Washington







TENNESSEE

Geo. F. Cram,

Publisher and Proprietor,

Chicago, Ill.

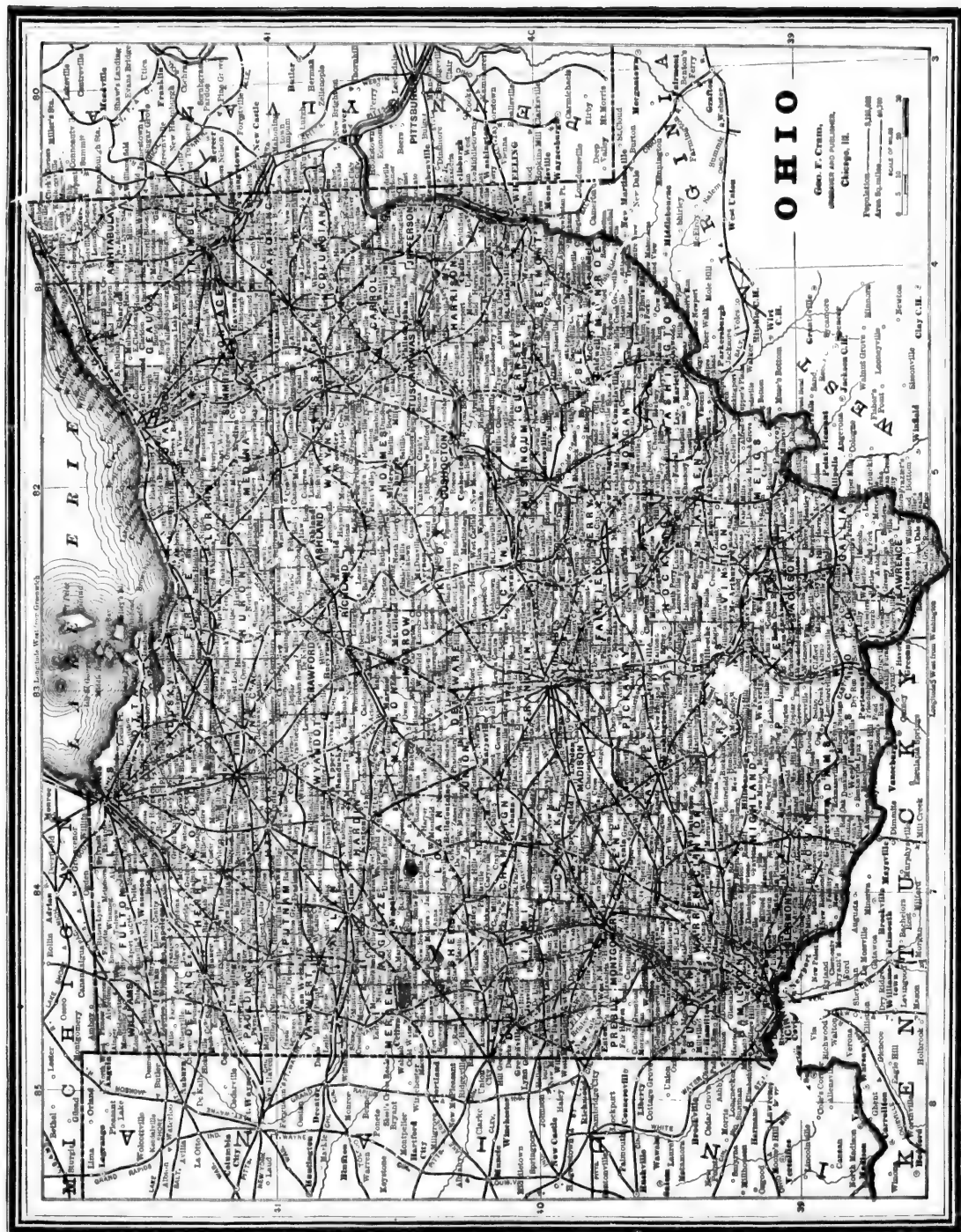
Scale of Miles

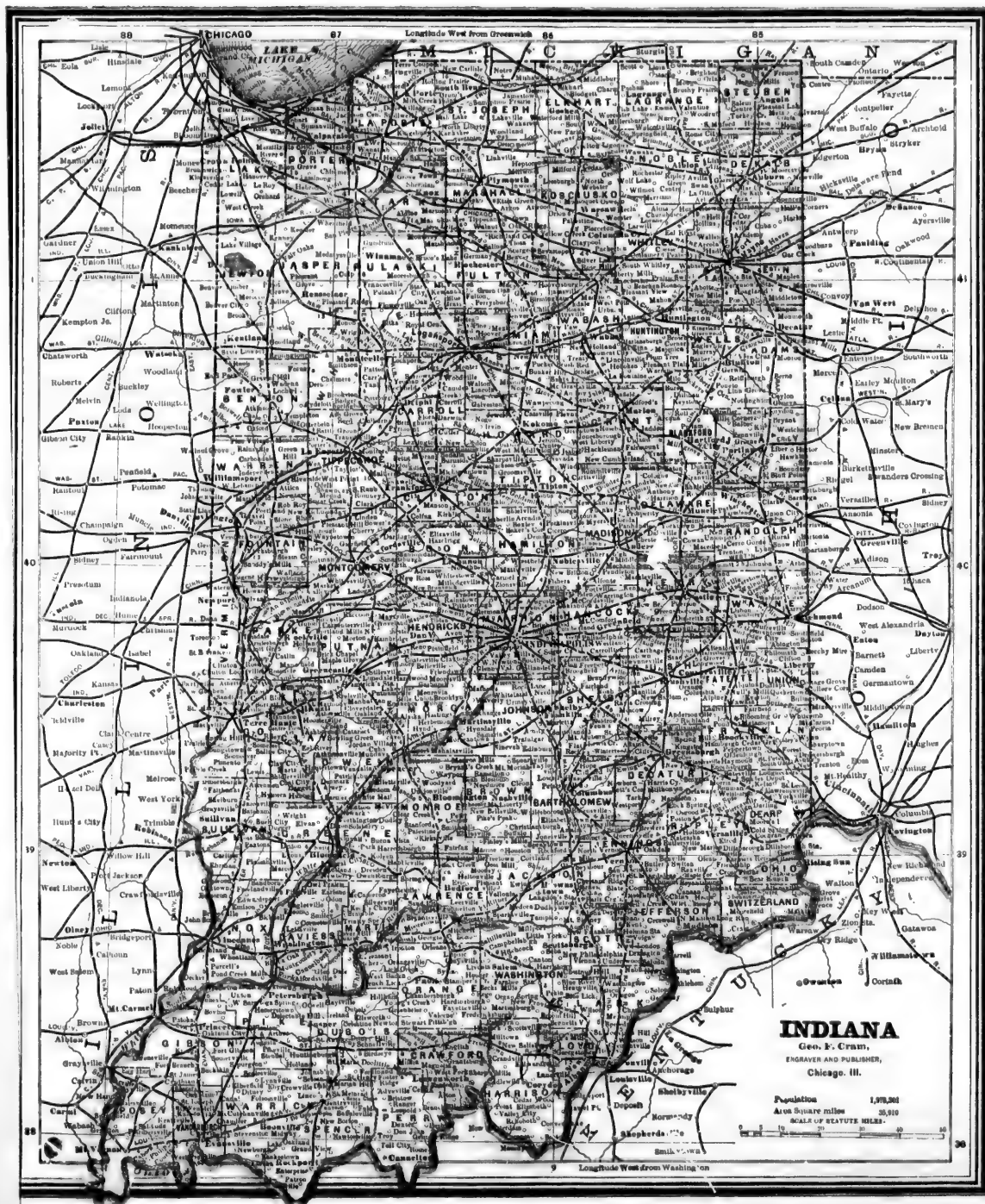


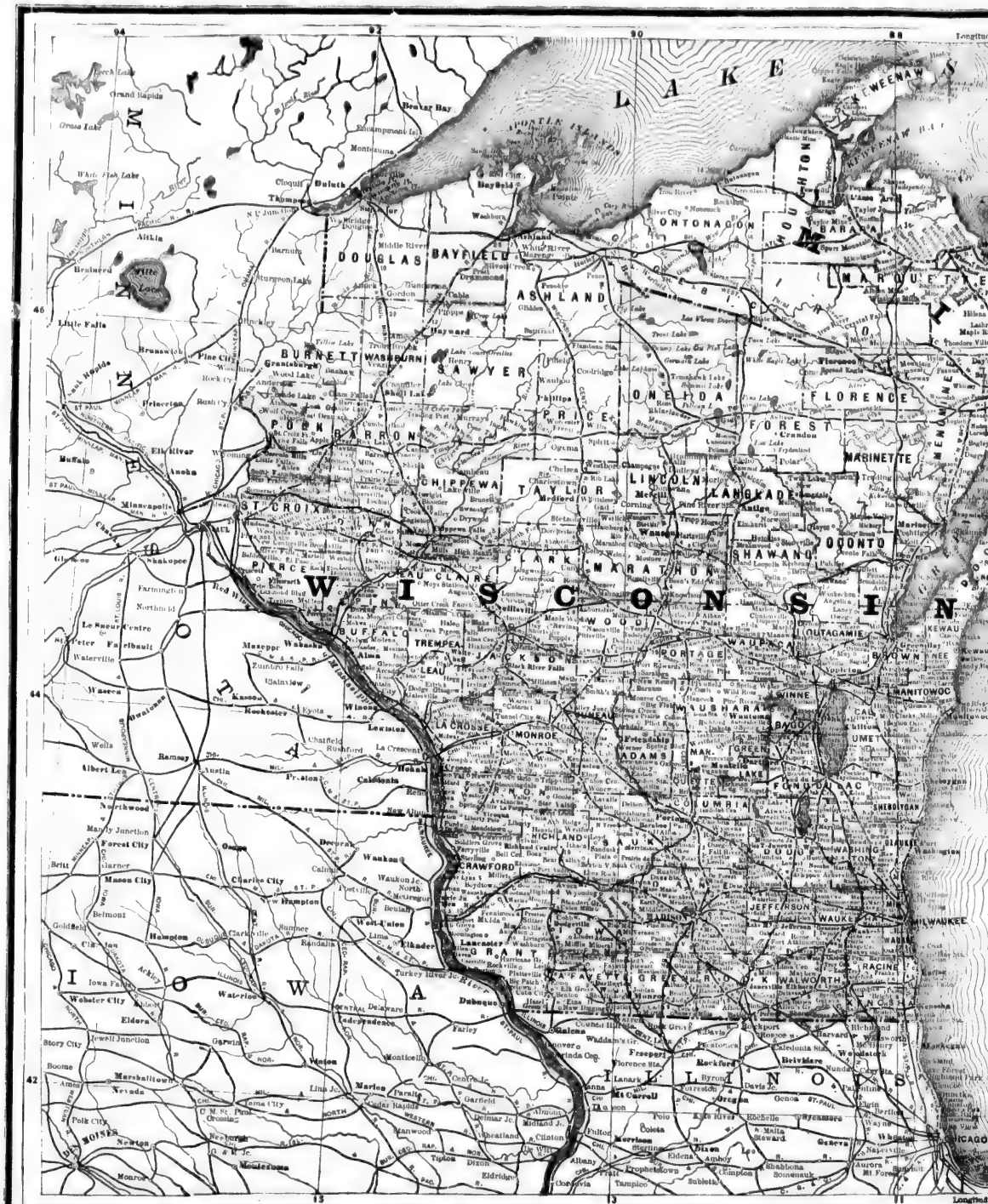
KENTUCKY

Scale of Miles



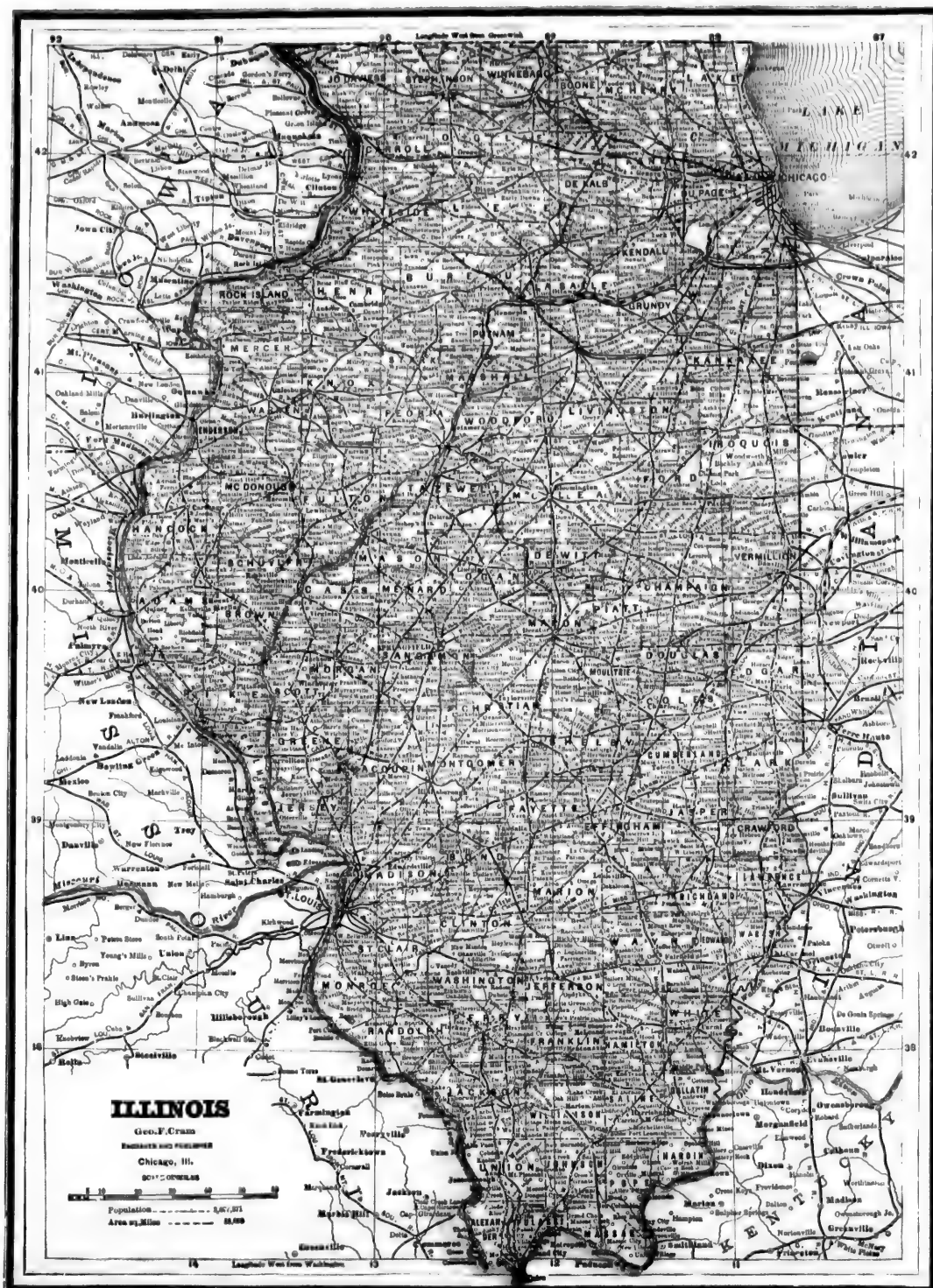






W16 Top 1,262,153 Area No. m. 54.60

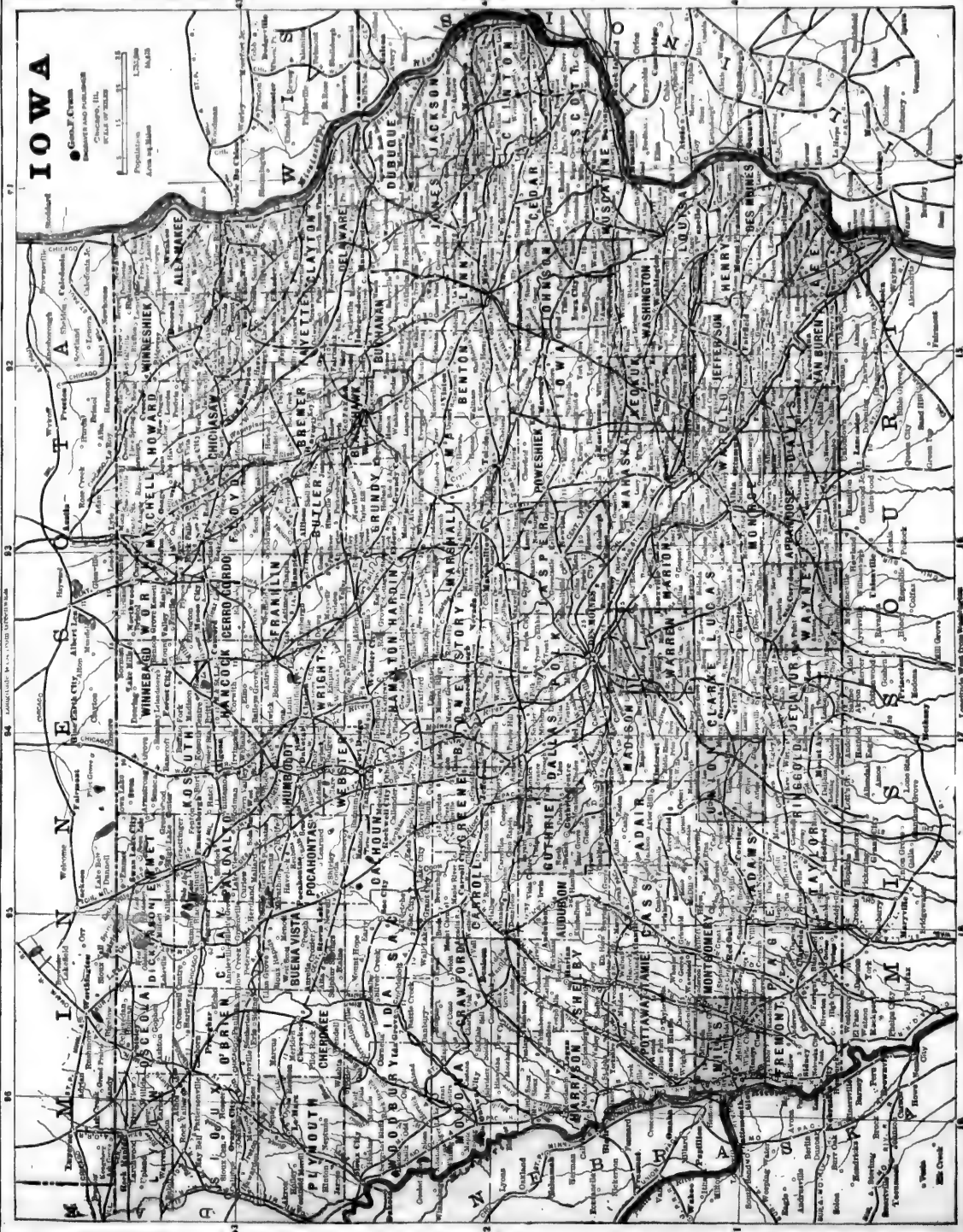


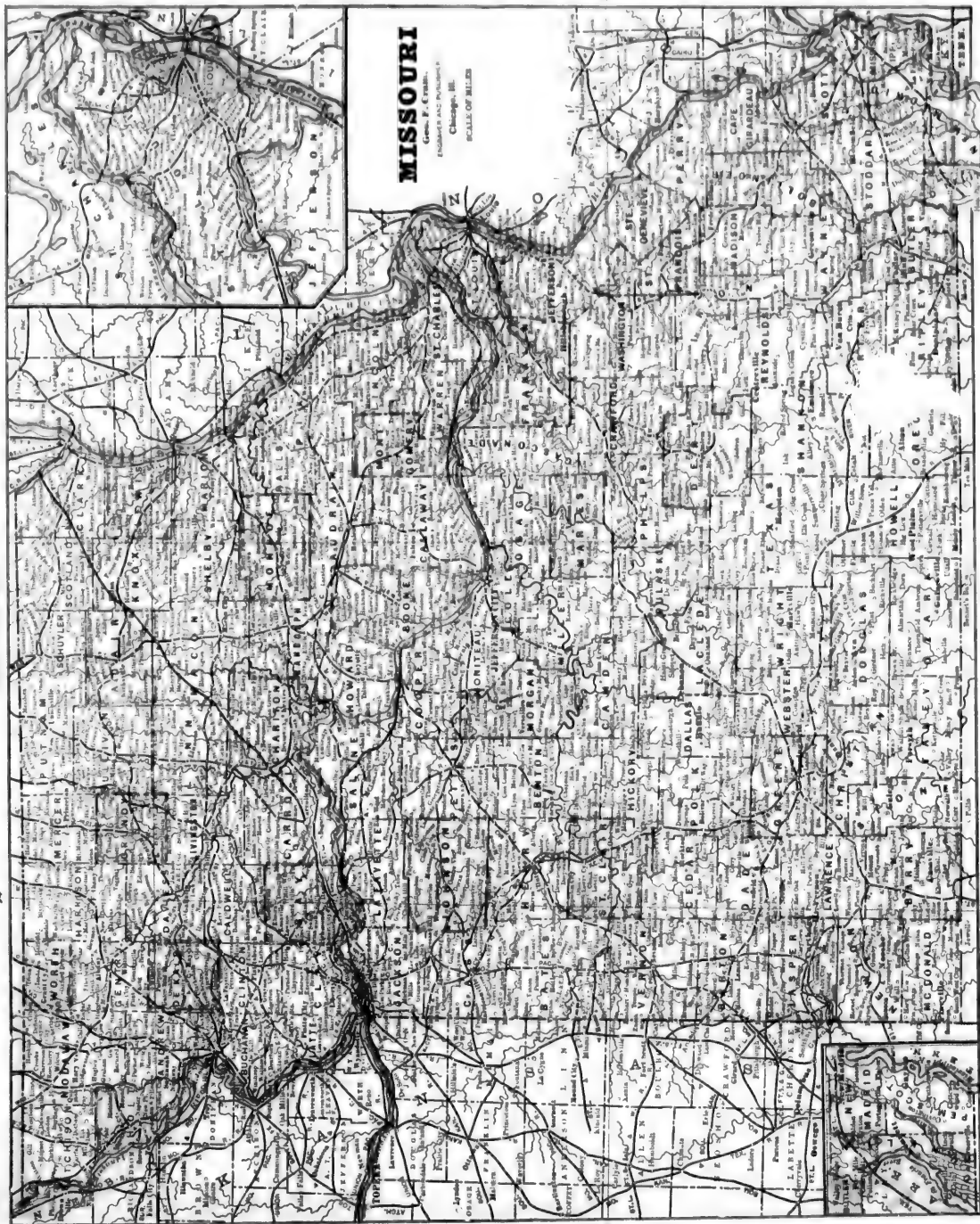


IOWA

• Gen. F. C. Brown
Manufacturers and Publishers
Chicago, Ill.
at Sale of Maps

Scale
1:125,000
Miles
Kilometers
Area in Square Miles
Area in Square Kilometers

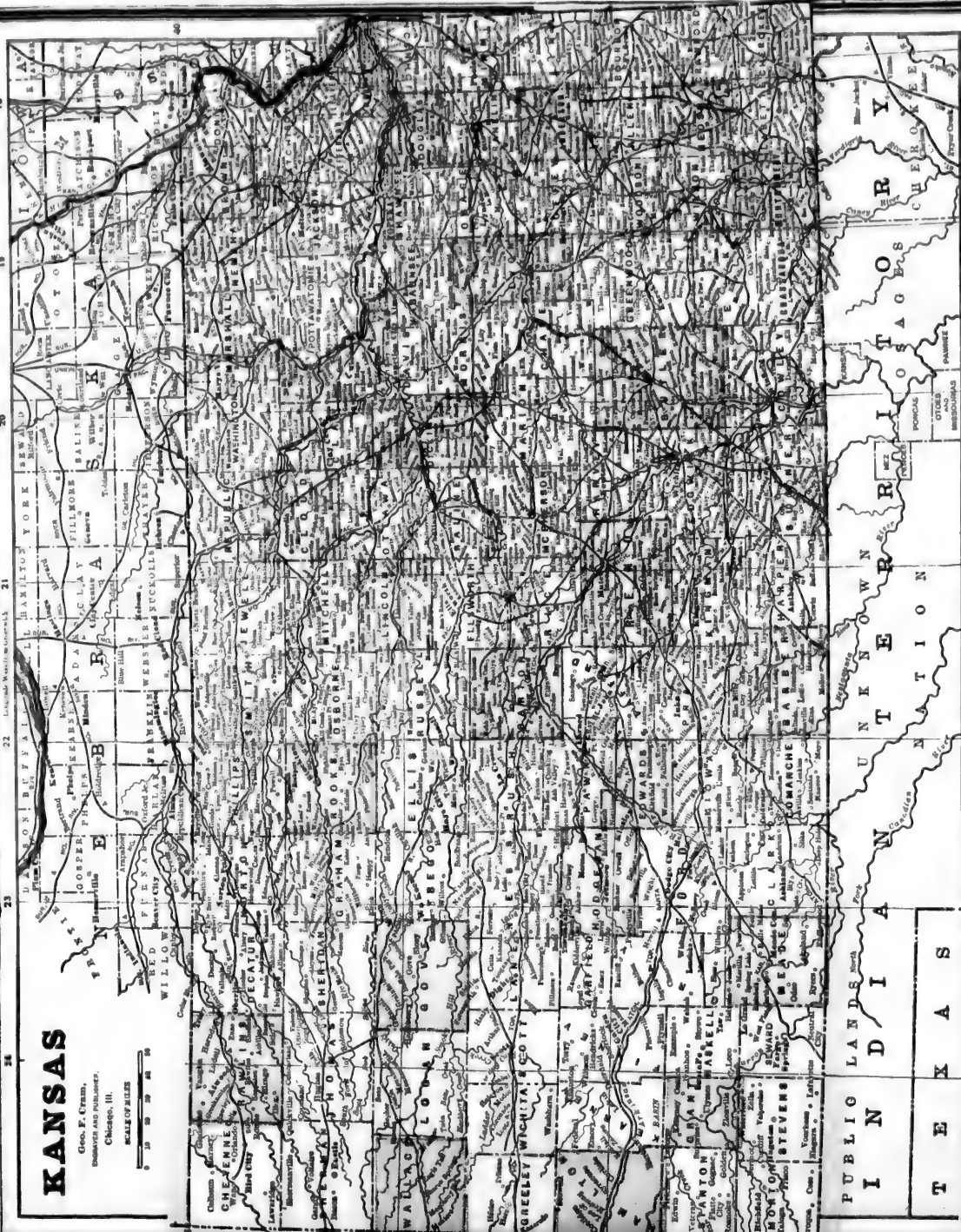




KANSAS

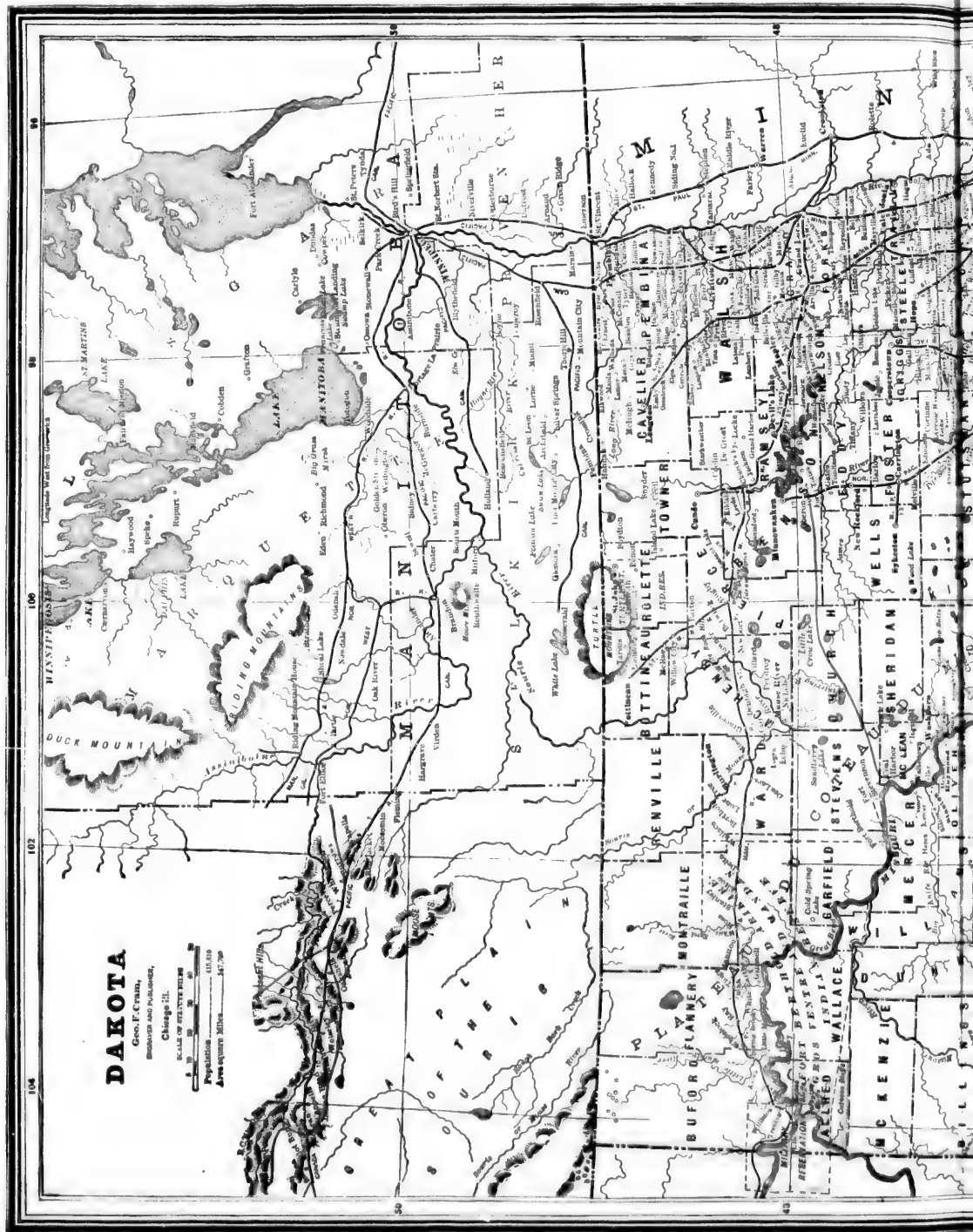
Geo. F. Cram,
Designer and Publisher,
Chicago, Ill.

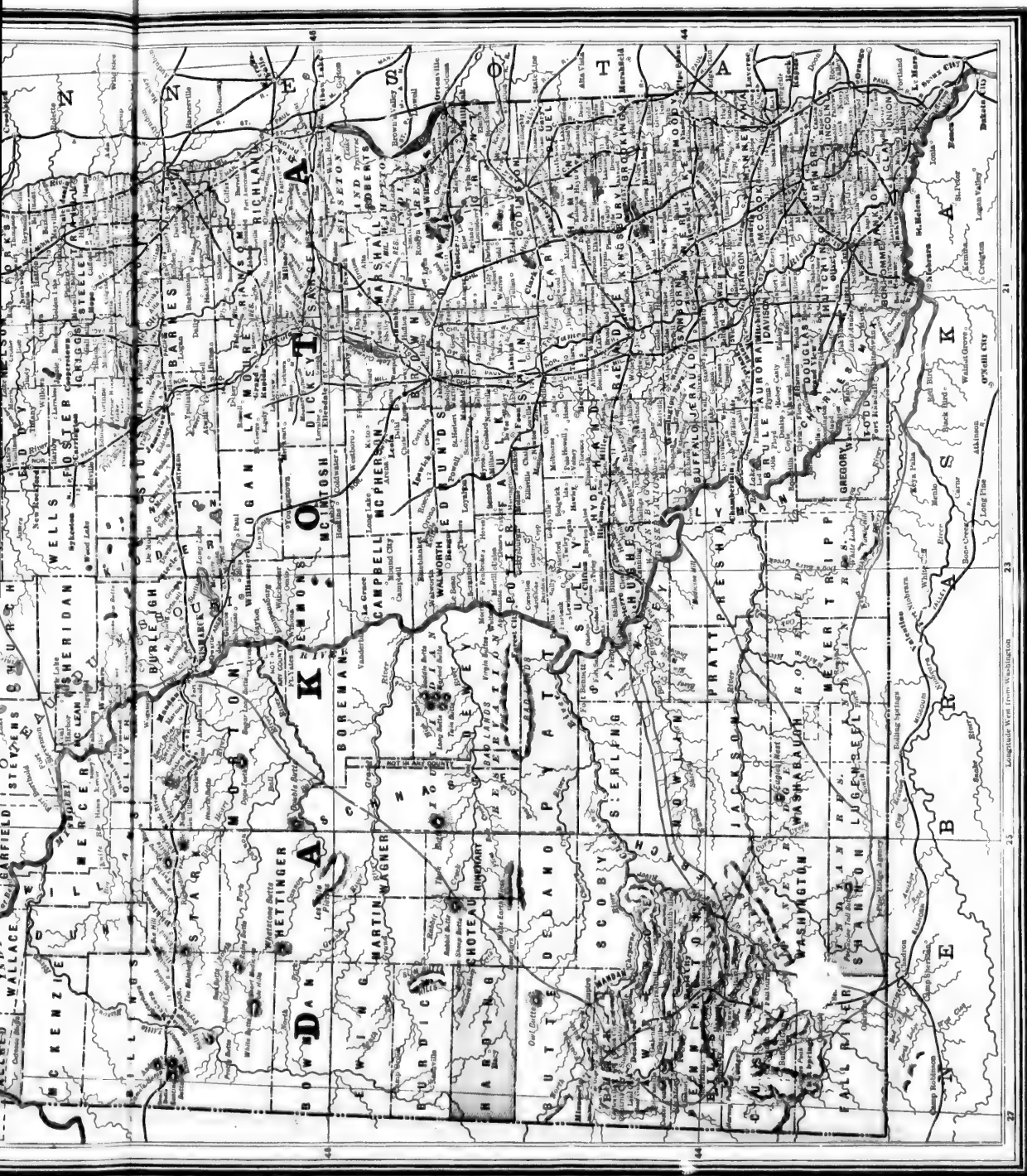
SCALE OF MILES
0 10 20 30 40

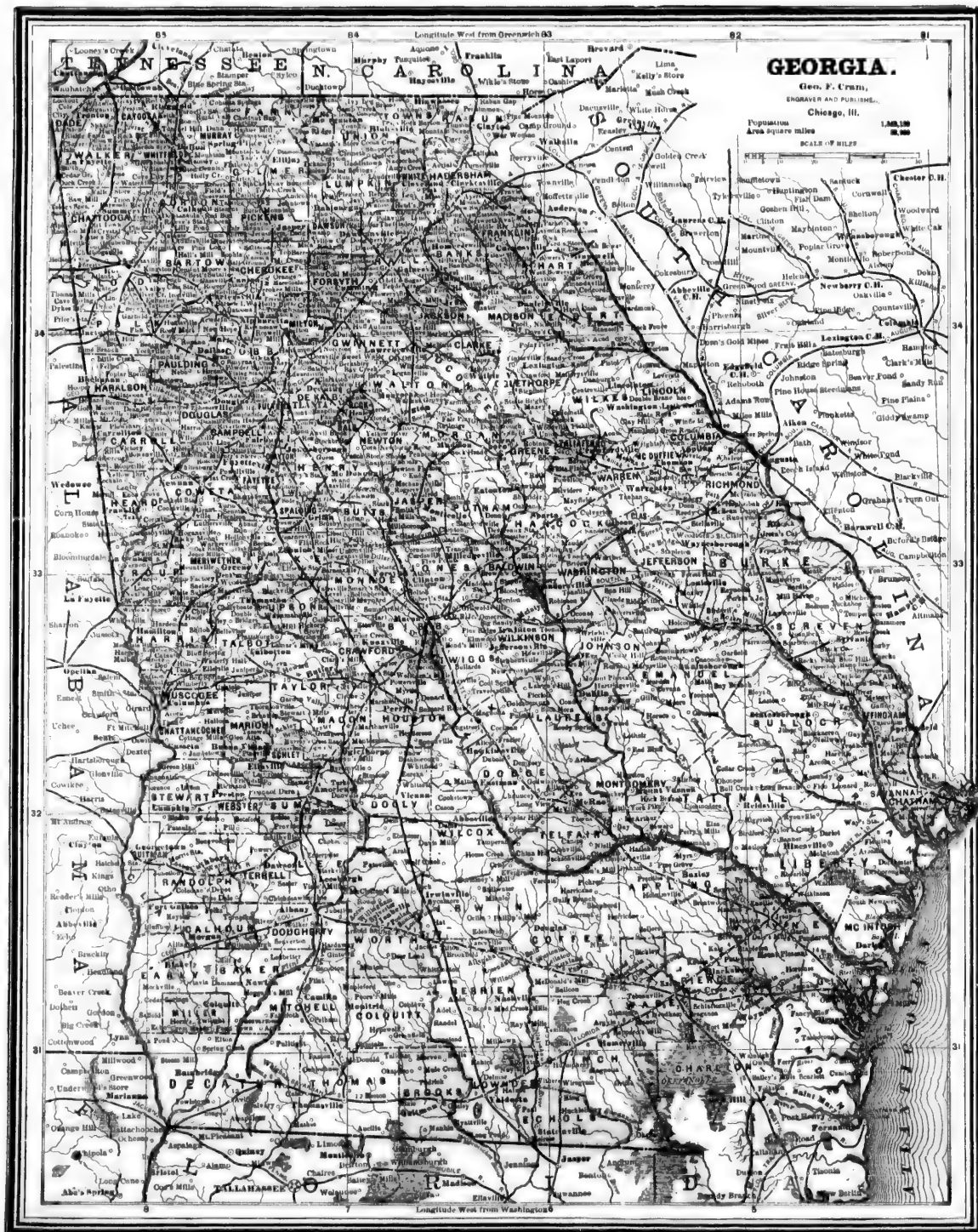


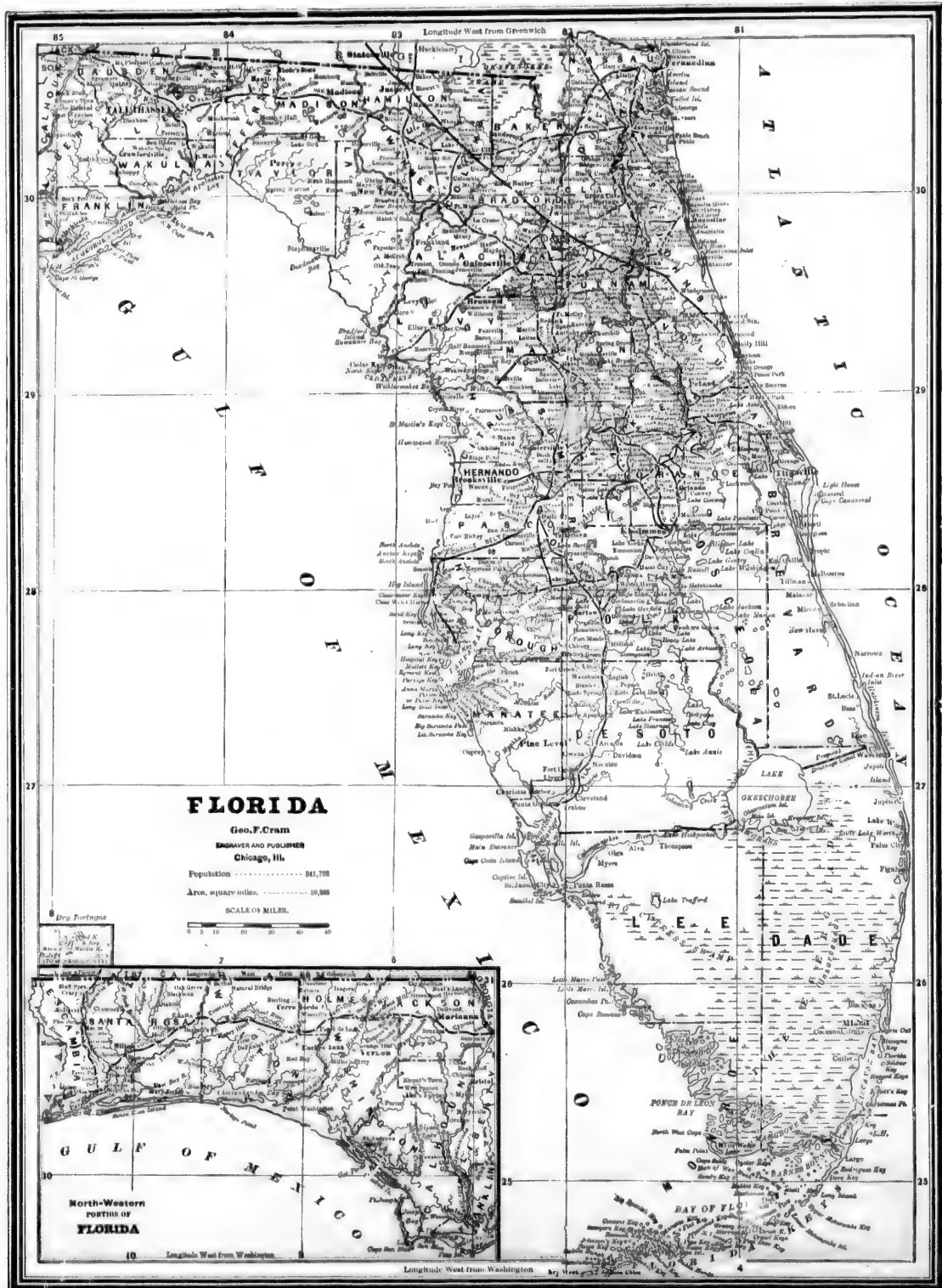
PUBLIC LANDS IN THE STATE OF KANSAS

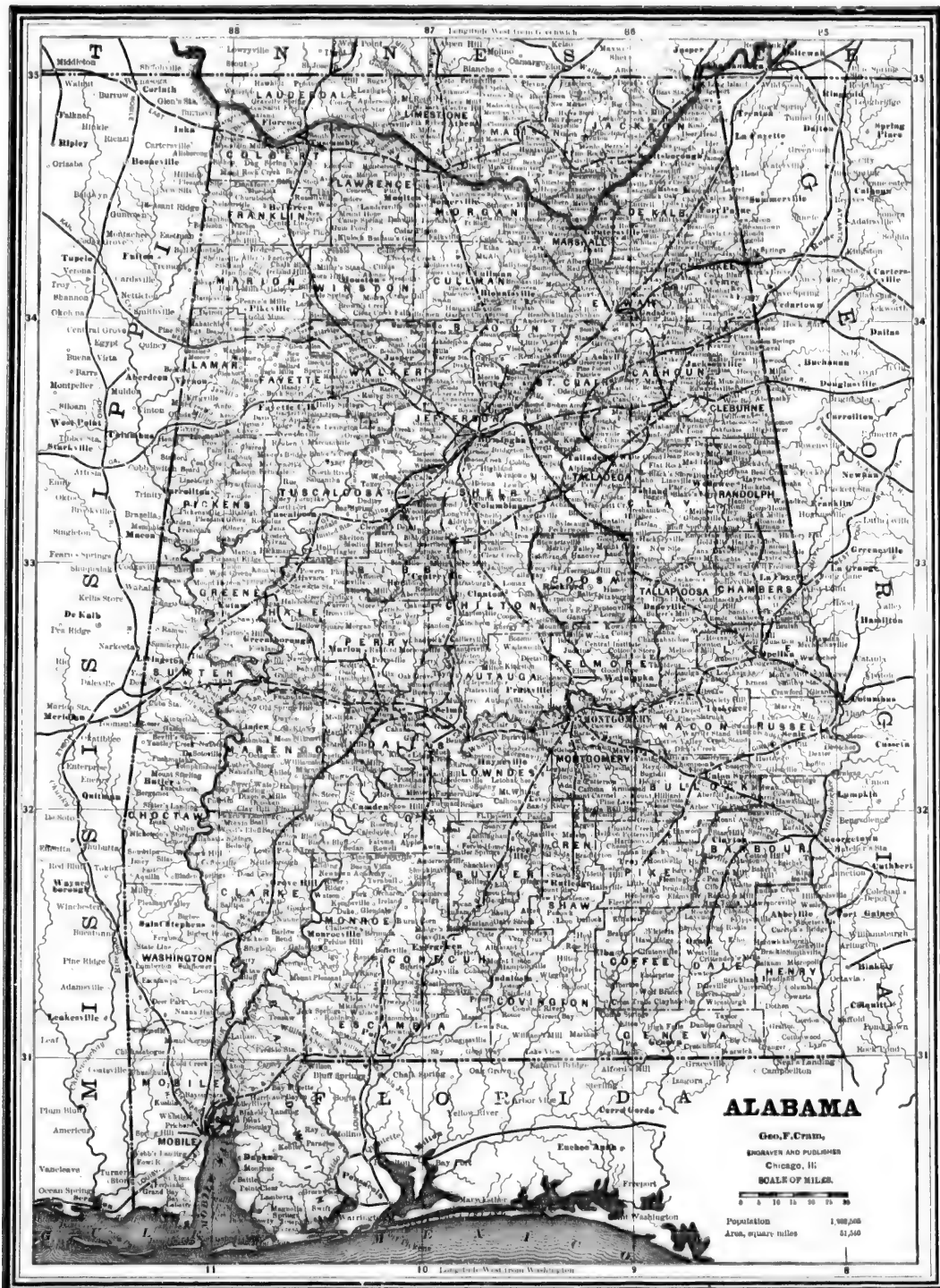










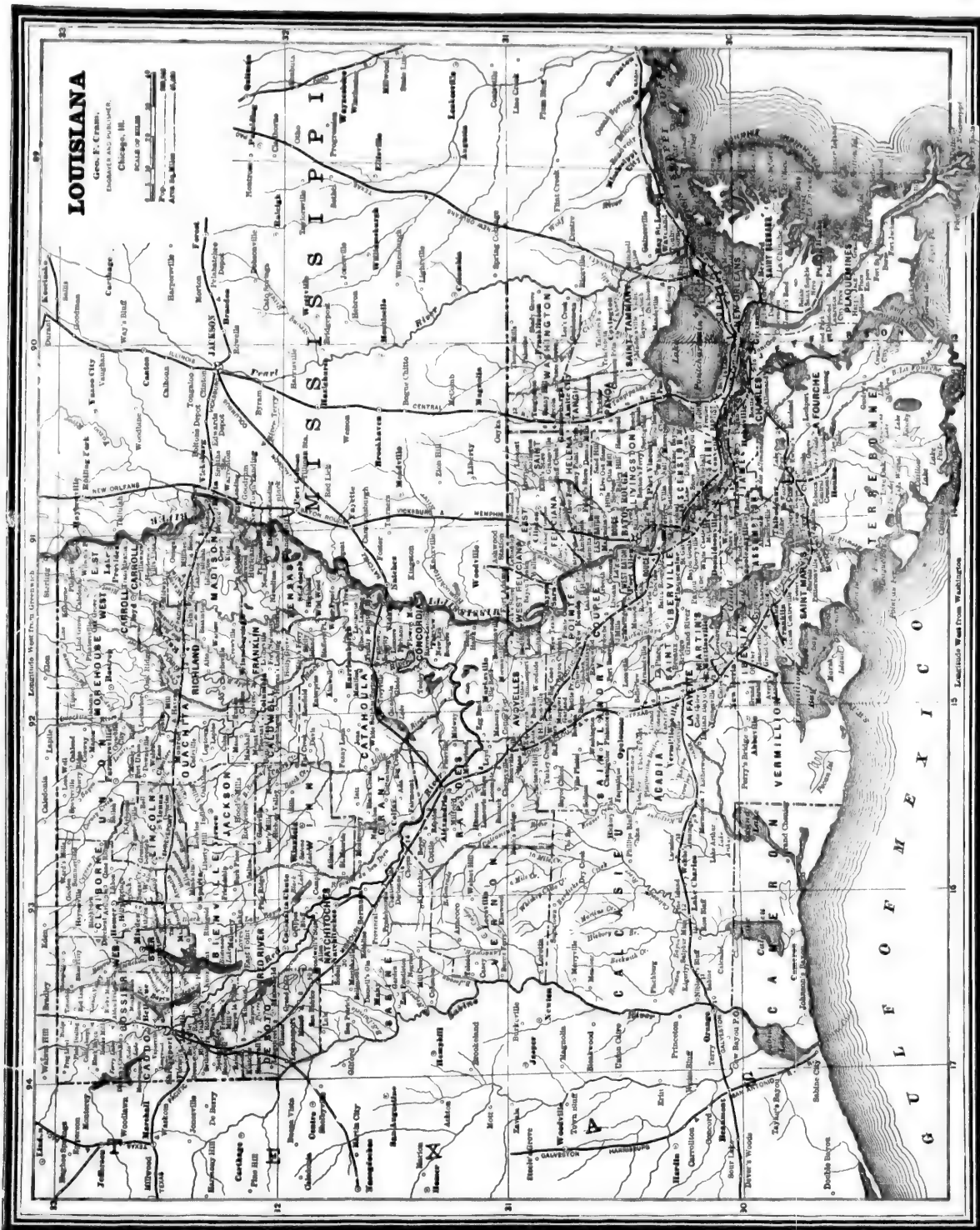


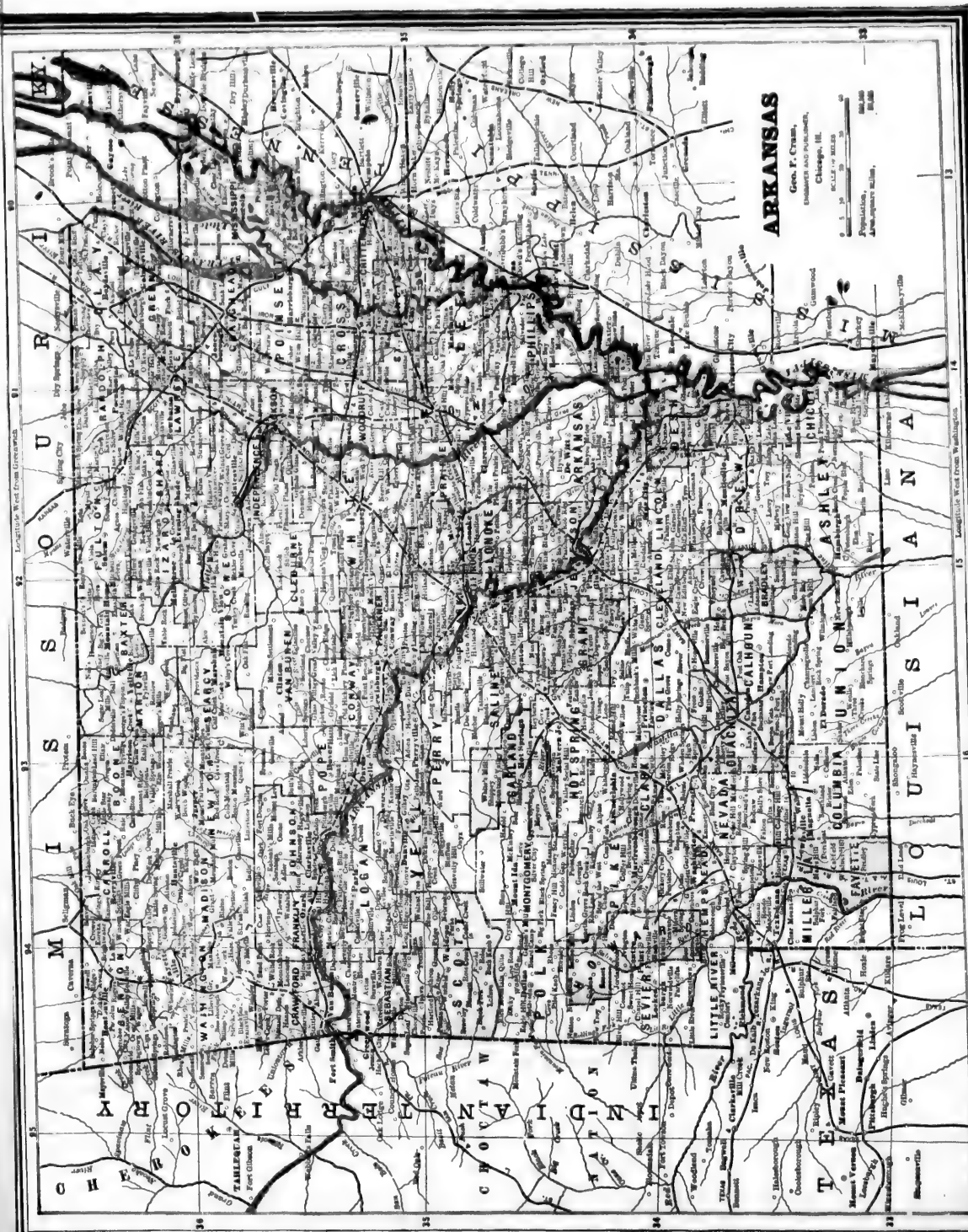


LOUISIANA

Geo. F. Cram,
Publisher and Proprietor,
Chicago, Ill.

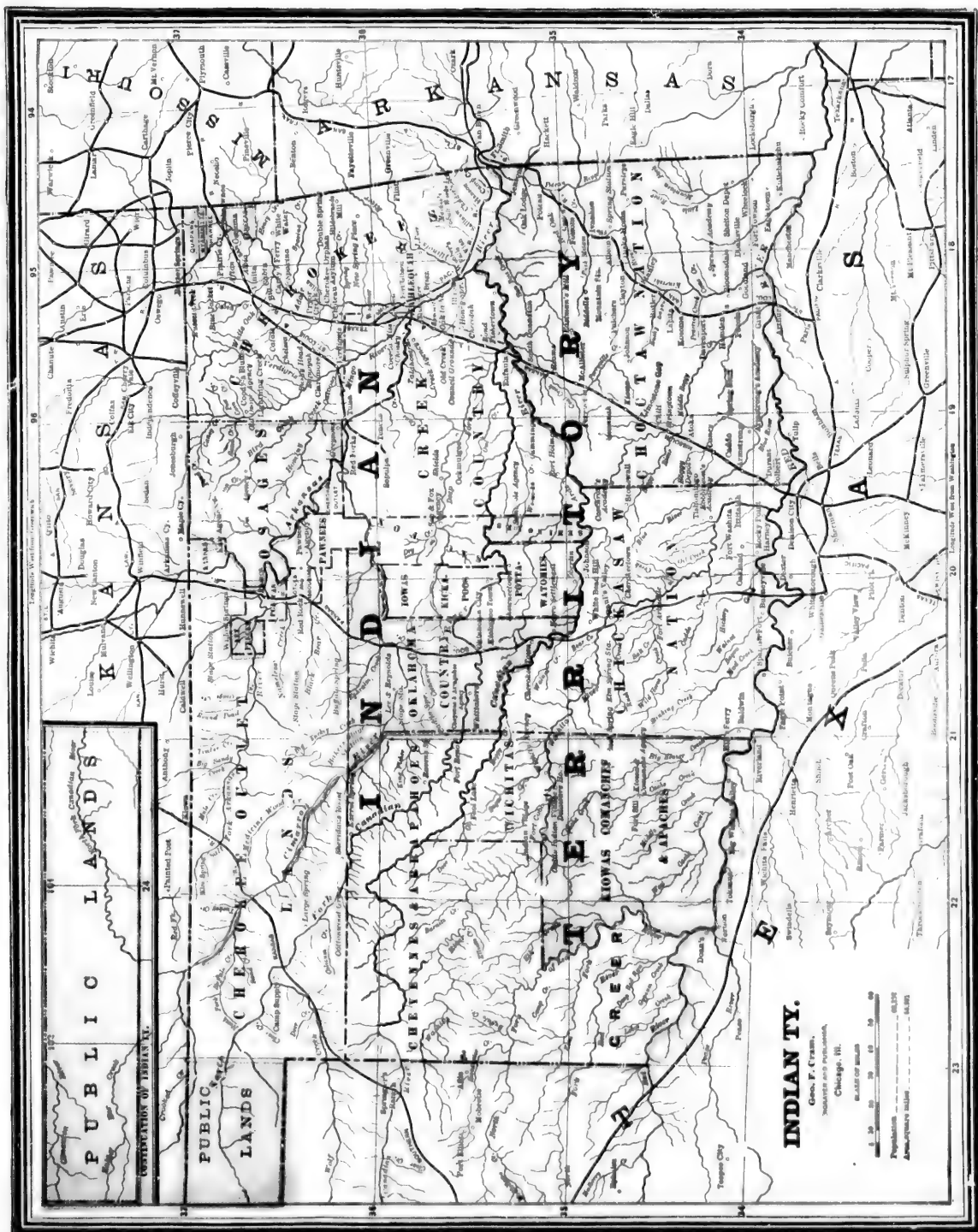
Scale of Miles
0 10 20 30 40 50
0 10 20 30 40 50
0 10 20 30 40 50
0 10 20 30 40 50

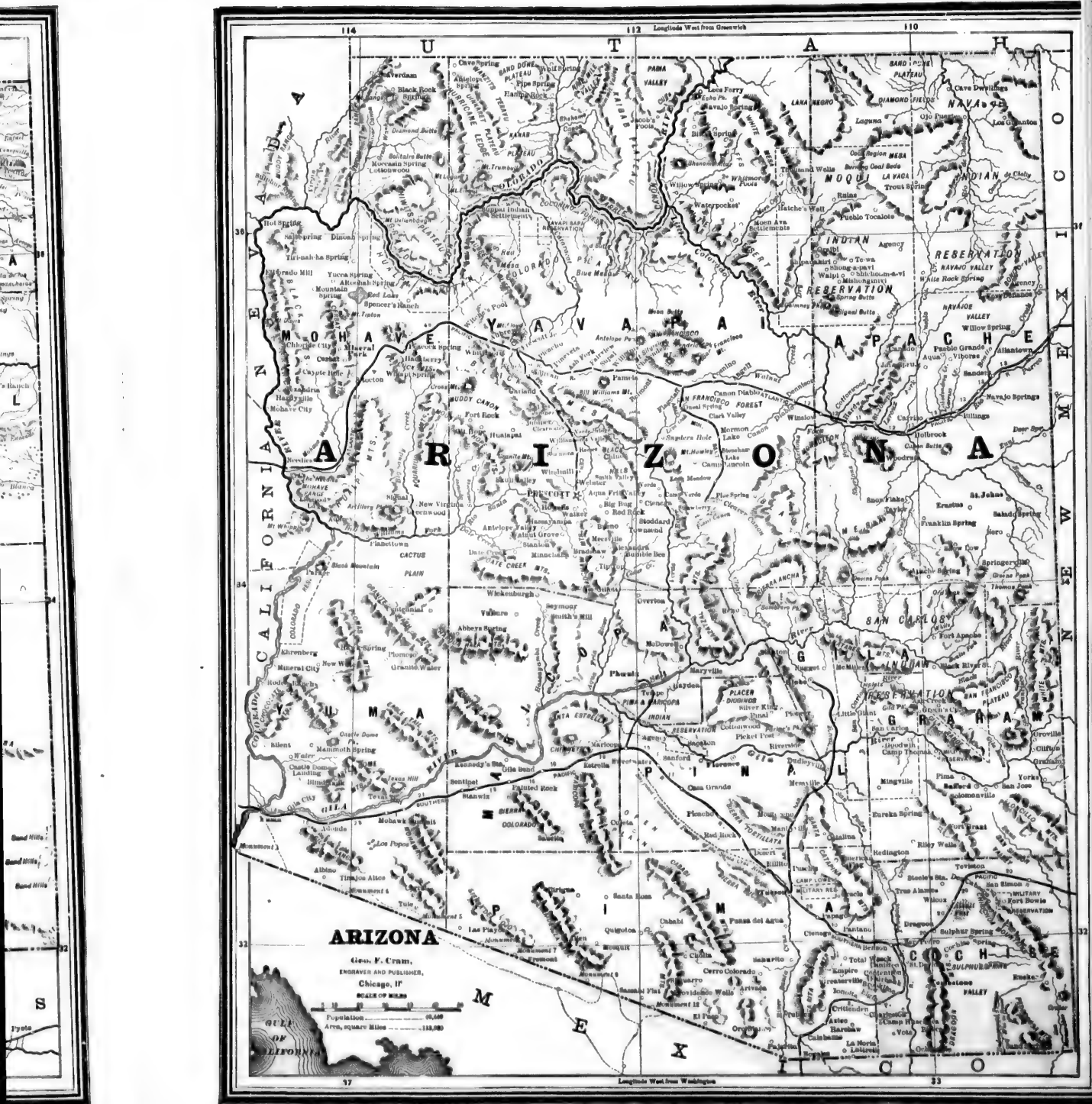


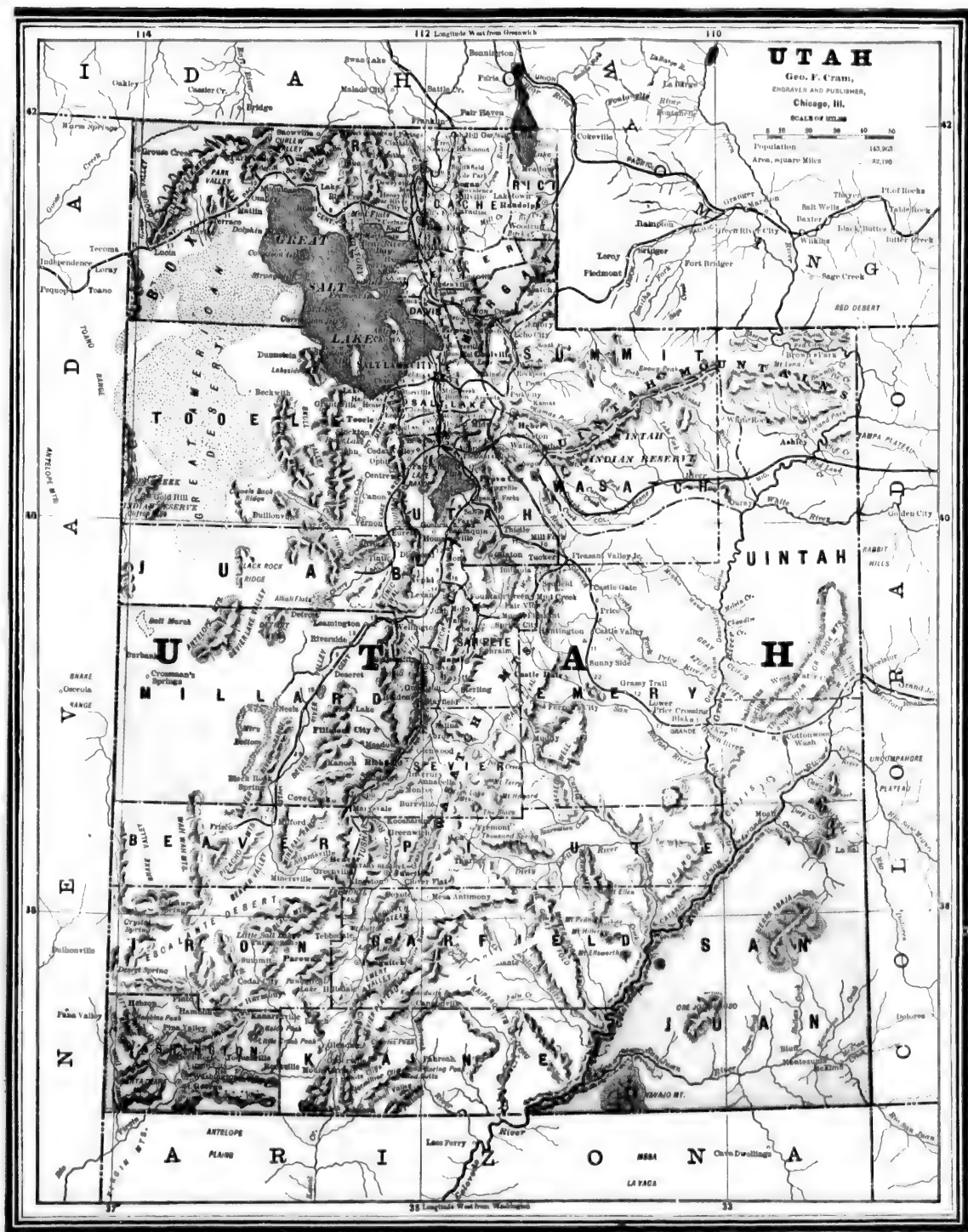


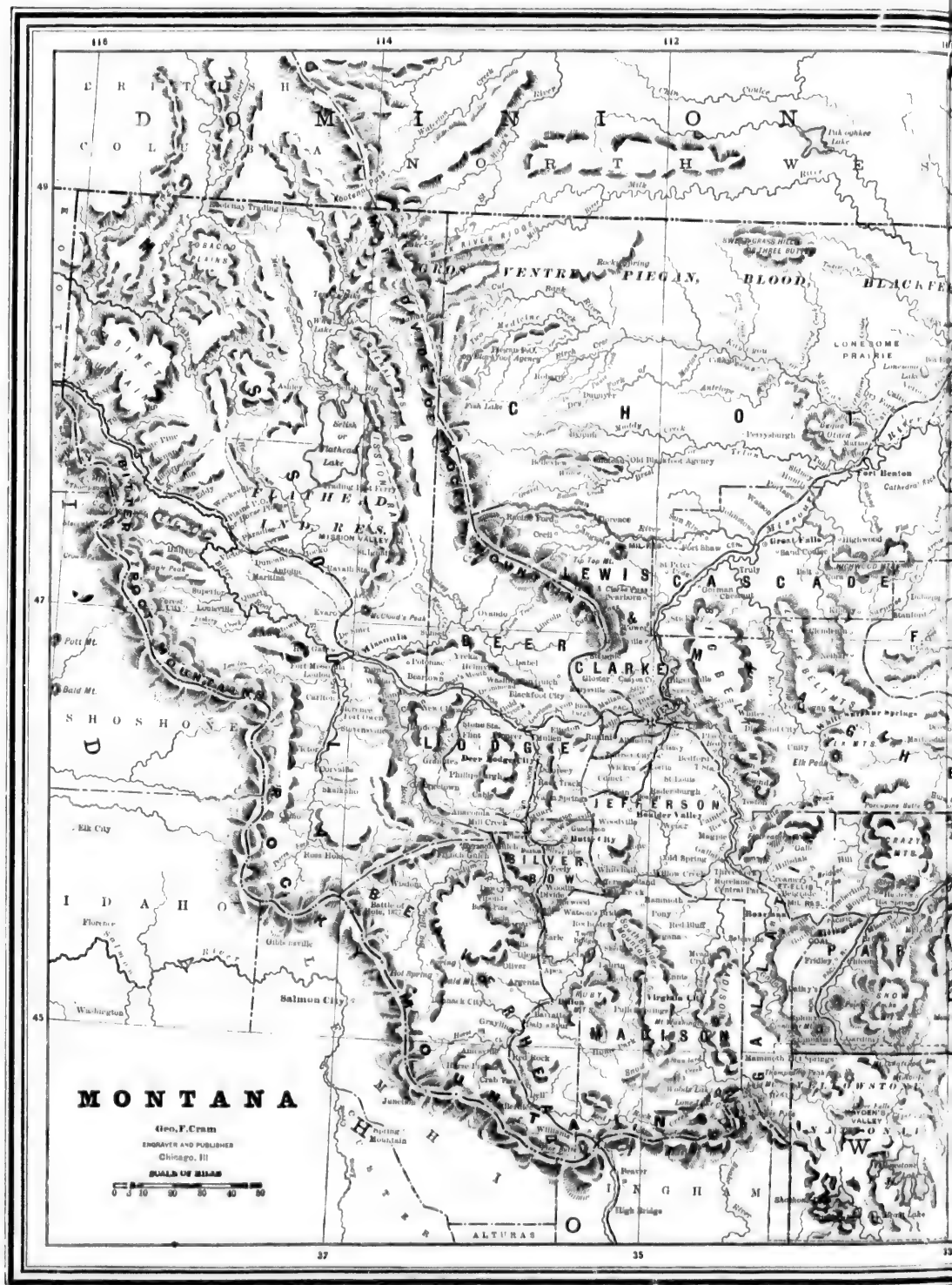












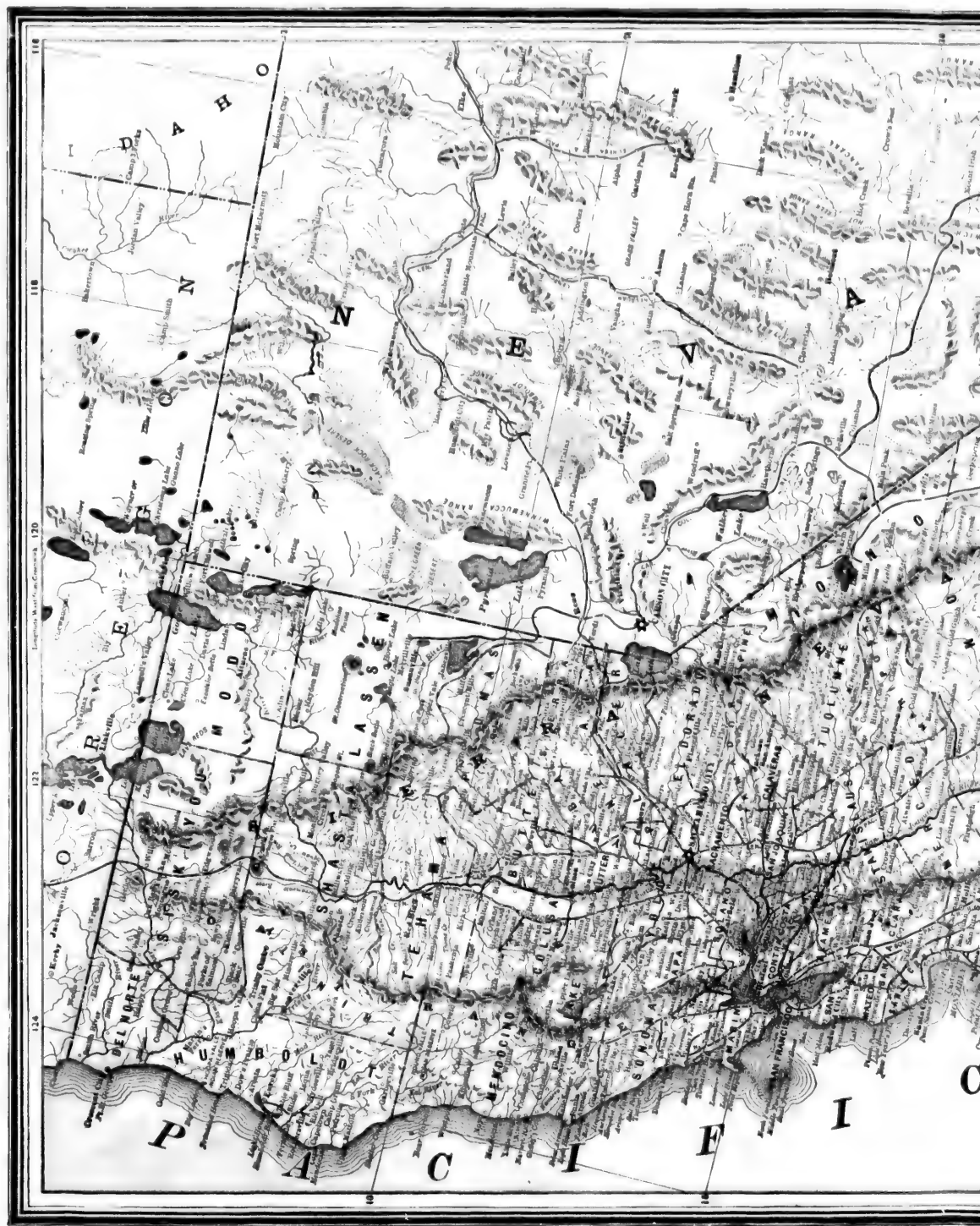
YELLOWSTONE NATIONAL PARK

WYOMING

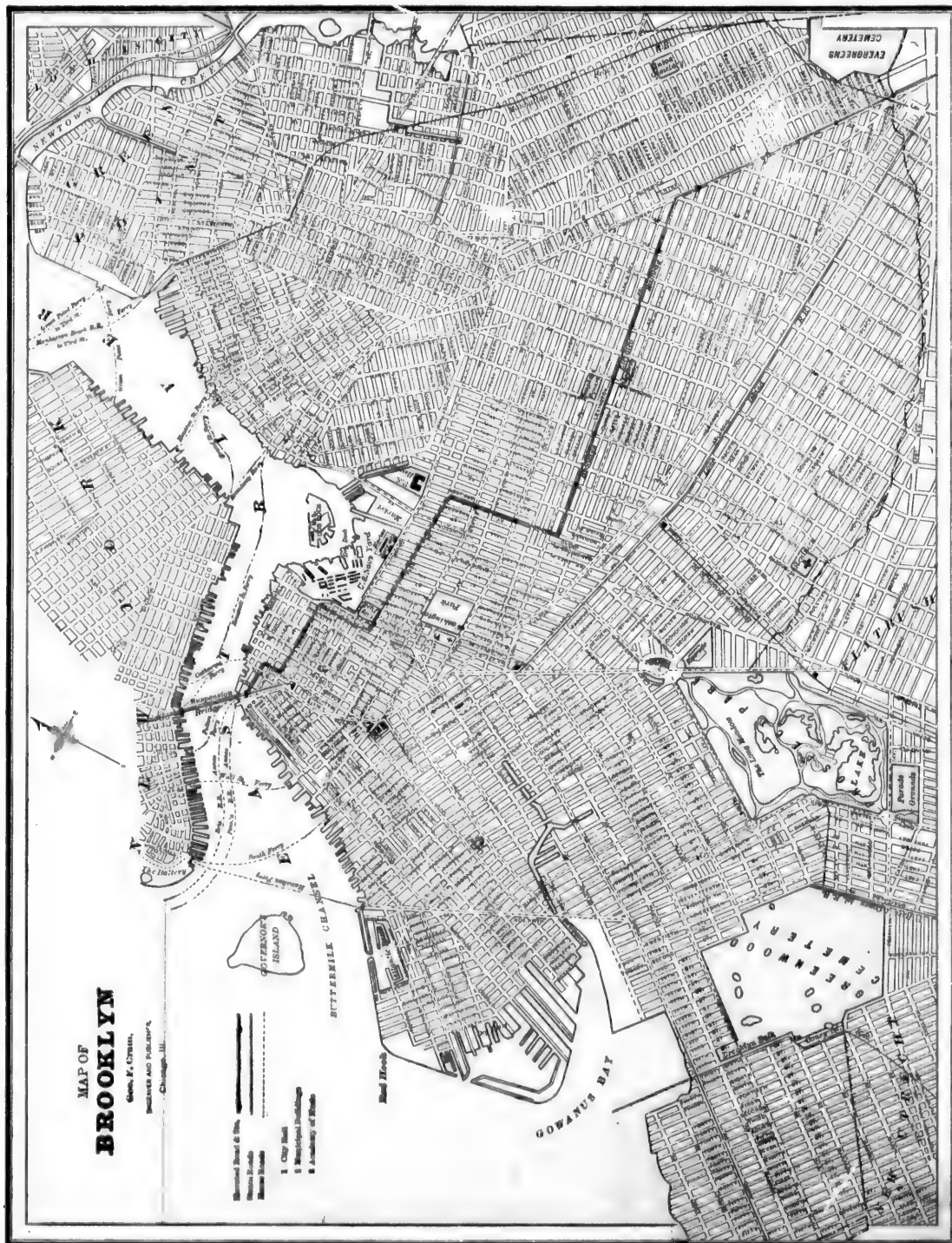






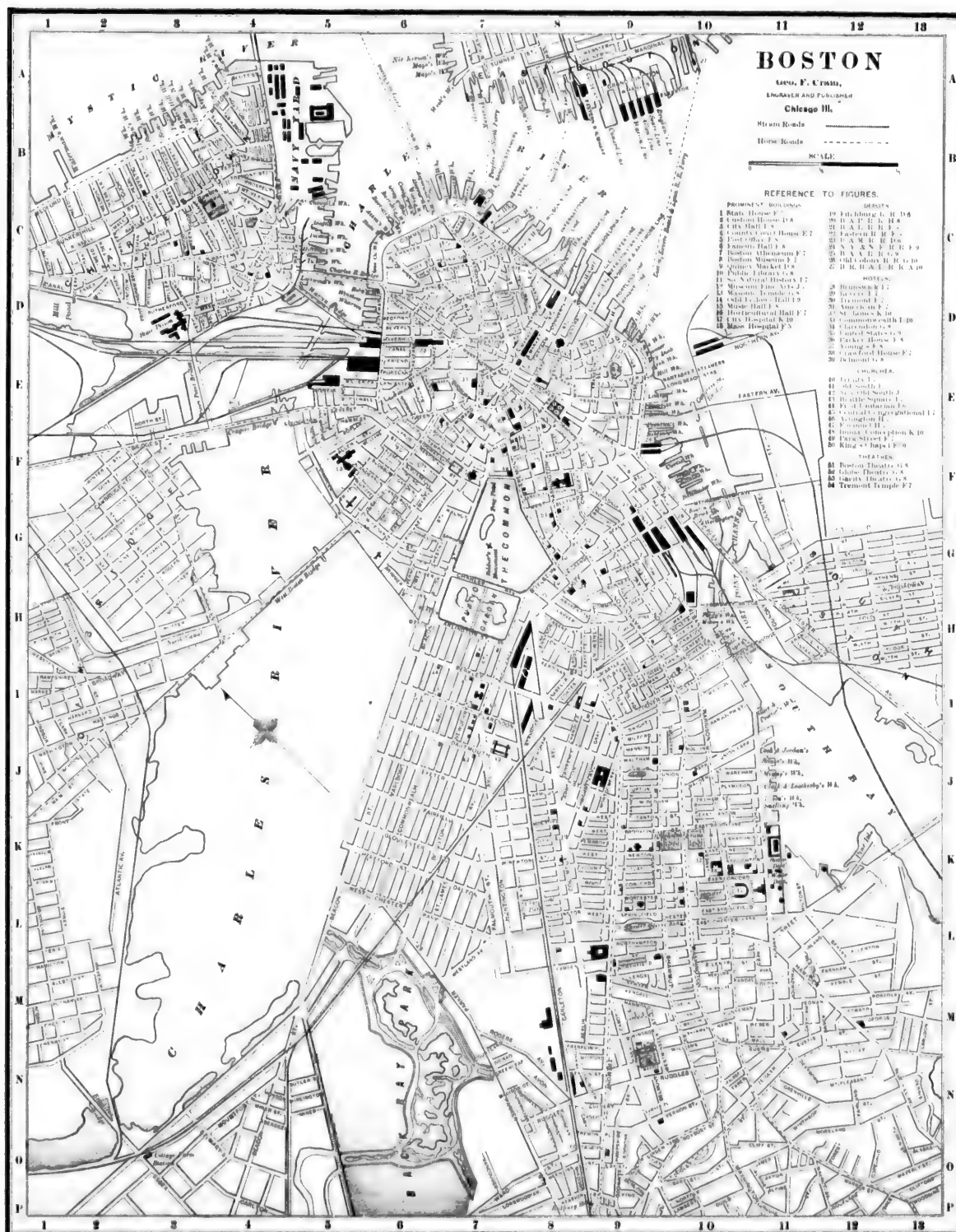






[illegible]

13. H. L. Williams	Washington, D.C.
12. J. B. Williams	12 North River
11. N. P. Norbert	11 North River
10. R. H. Norbert	10 North River
9. R. H. Norbert	9 North River
8. J. B. Williams	Washington and Georgetown, D.C.
7. J. B. Williams	Washington and Georgetown, D.C.
6. J. B. Williams	Washington and Georgetown, D.C.
5. J. B. Williams	Washington and Georgetown, D.C.
4. J. B. Williams	Washington and Georgetown, D.C.
3. J. B. Williams	Washington and Georgetown, D.C.
2. J. B. Williams	Washington and Georgetown, D.C.
1. J. B. Williams	Washington and Georgetown, D.C.



BOSTON

ALLEN F. CURRIE,
ENGINEER AND PUBLISHER
Chicago Ill.

Steam Roads
Horse Roads
SCALE

REFERENCE TO FIGURES.

- PROMINENT BUILDINGS
- 1 State House F
 - 2 Custom House F
 - 3 City Hall F
 - 4 County Court House F
 - 5 Post Office F
 - 6 Faneuil Hall F
 - 7 Boston Athenaeum F
 - 8 Boston Museum F
 - 9 Quincy Market F
 - 10 Public Library F
 - 11 No. National History F
 - 12 Museum Fine Arts F
 - 13 Masonic Temple F
 - 14 Old State House F
 - 15 Music Hall F
 - 16 North Church F
 - 17 City Hospital F
 - 18 Mass. Hospital F
- CHURCHES
- 19 Faneuil Hall F
 - 20 St. Paul's F
 - 21 St. James F
 - 22 St. Ann F
 - 23 St. Mary F
 - 24 St. John F
 - 25 St. Peter F
 - 26 St. Michael F
 - 27 St. George F
 - 28 St. Andrew F
 - 29 St. Patrick F
 - 30 St. Francis F
 - 31 St. Vincent F
 - 32 St. Elizabeth F
 - 33 St. Joseph F
 - 34 St. Anthony F
 - 35 St. Charles F
 - 36 St. Ignace F
 - 37 St. Francis F
 - 38 St. James F
 - 39 St. John F
 - 40 St. Peter F
 - 41 St. Michael F
 - 42 St. George F
 - 43 St. Andrew F
 - 44 St. Patrick F
 - 45 St. Francis F
 - 46 St. Vincent F
 - 47 St. Elizabeth F
 - 48 St. Joseph F
 - 49 St. Anthony F
 - 50 St. Charles F
 - 51 St. Ignace F
 - 52 St. Francis F
 - 53 St. James F
 - 54 St. John F
 - 55 St. Peter F
 - 56 St. Michael F
 - 57 St. George F
 - 58 St. Andrew F
 - 59 St. Patrick F
 - 60 St. Francis F
 - 61 St. Vincent F
 - 62 St. Elizabeth F
 - 63 St. Joseph F
 - 64 St. Anthony F
 - 65 St. Charles F
 - 66 St. Ignace F
 - 67 St. Francis F
 - 68 St. James F
 - 69 St. John F
 - 70 St. Peter F
 - 71 St. Michael F
 - 72 St. George F
 - 73 St. Andrew F
 - 74 St. Patrick F
 - 75 St. Francis F
 - 76 St. Vincent F
 - 77 St. Elizabeth F
 - 78 St. Joseph F
 - 79 St. Anthony F
 - 80 St. Charles F
 - 81 St. Ignace F
 - 82 St. Francis F
 - 83 St. James F
 - 84 St. John F
 - 85 St. Peter F
 - 86 St. Michael F
 - 87 St. George F
 - 88 St. Andrew F
 - 89 St. Patrick F
 - 90 St. Francis F
 - 91 St. Vincent F
 - 92 St. Elizabeth F
 - 93 St. Joseph F
 - 94 St. Anthony F
 - 95 St. Charles F
 - 96 St. Ignace F
 - 97 St. Francis F
 - 98 St. James F
 - 99 St. John F
 - 100 St. Peter F

MONTREAL

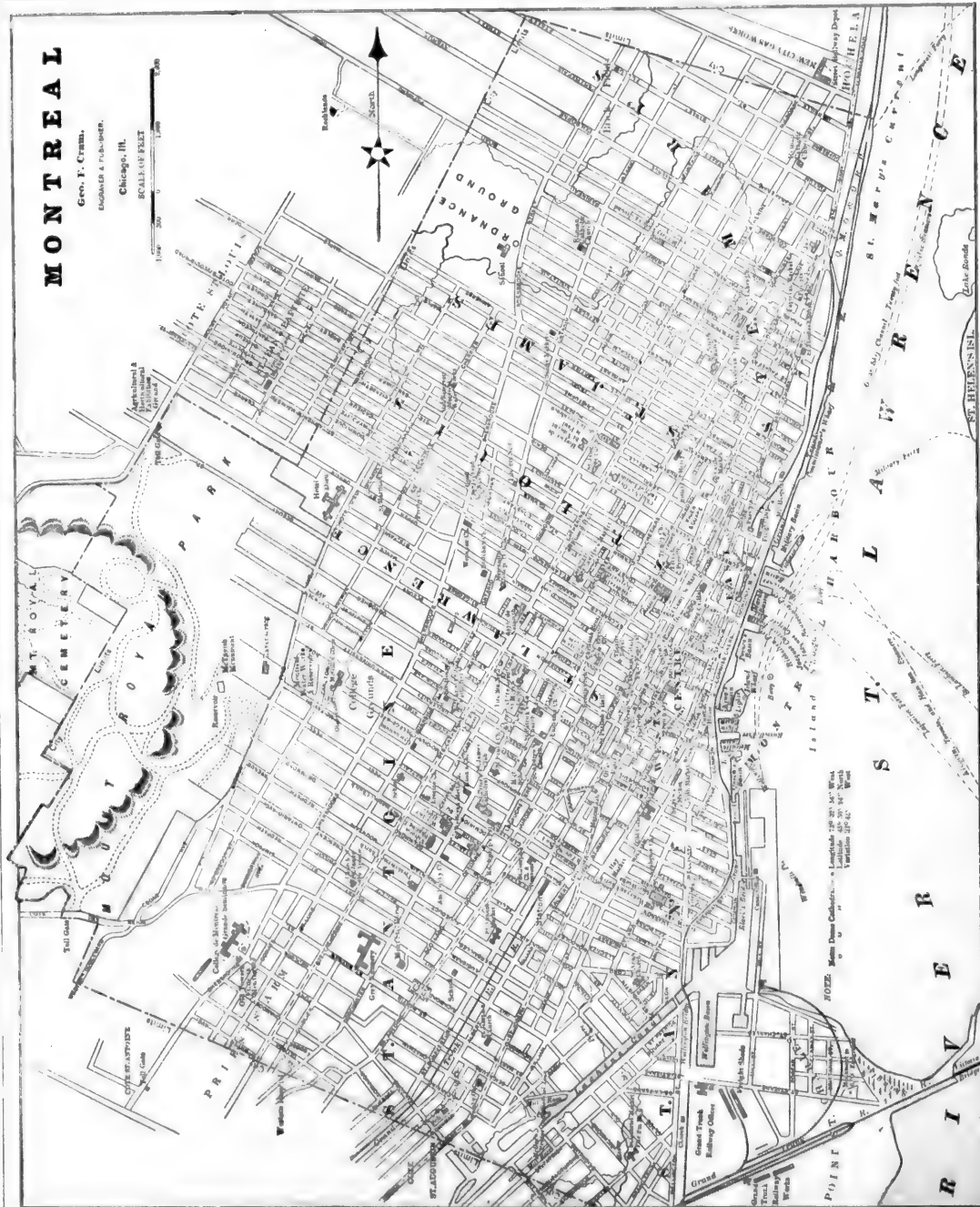
Geo. F. Cram.

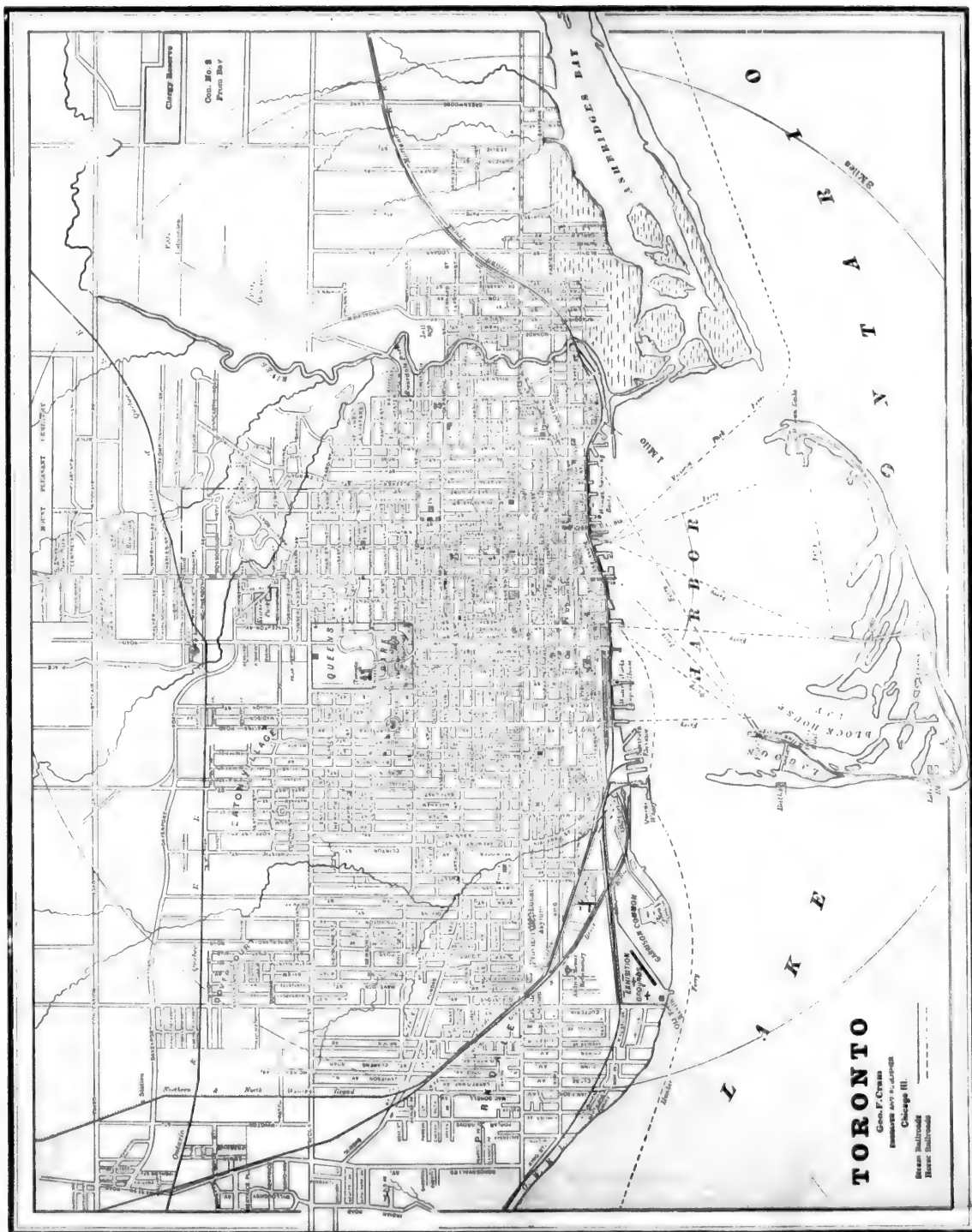
Engraver & Publisher.

Chicago, Ill.

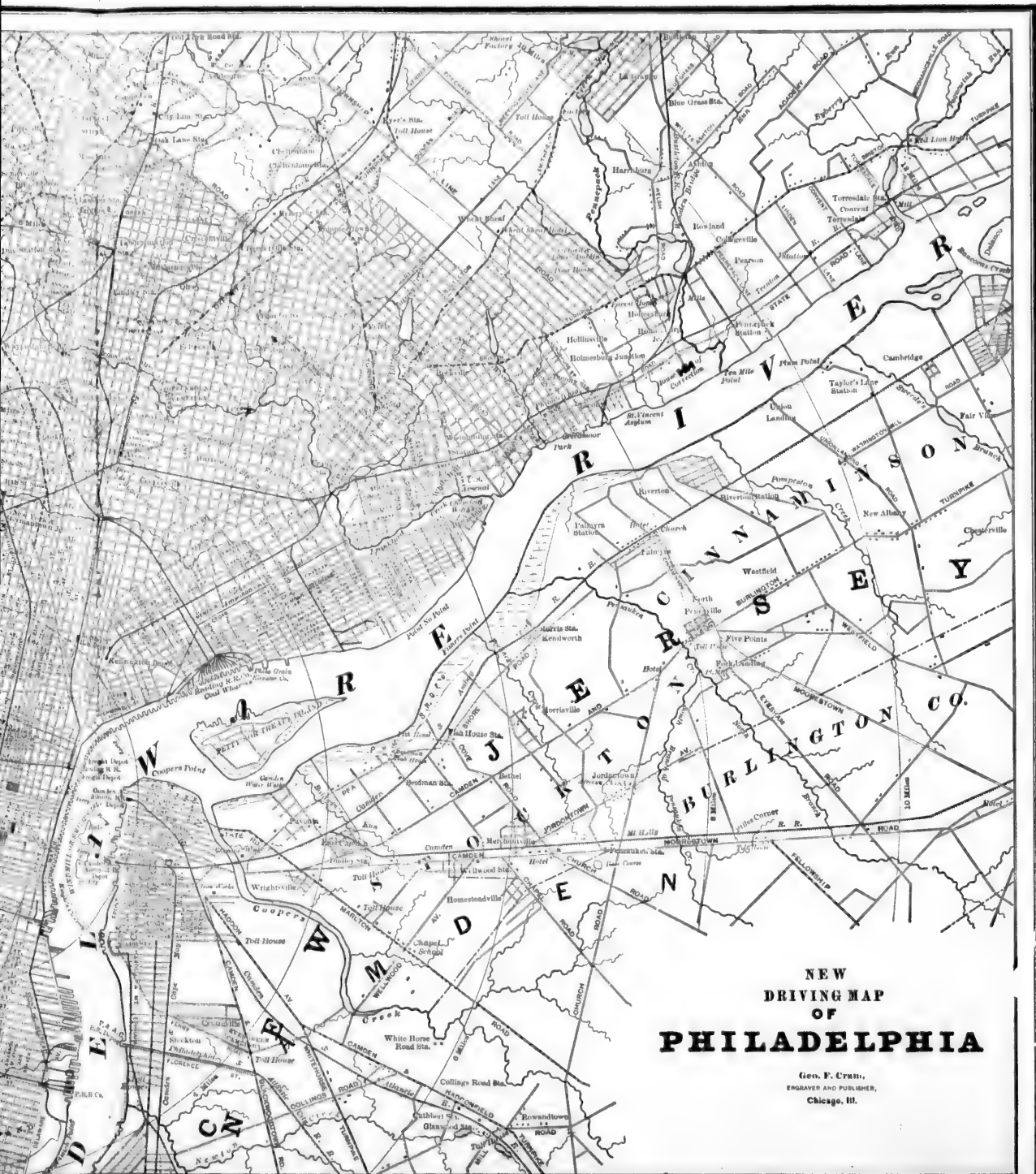
ROLLS OF RAIL

1:50,000 0 1,000 2,000



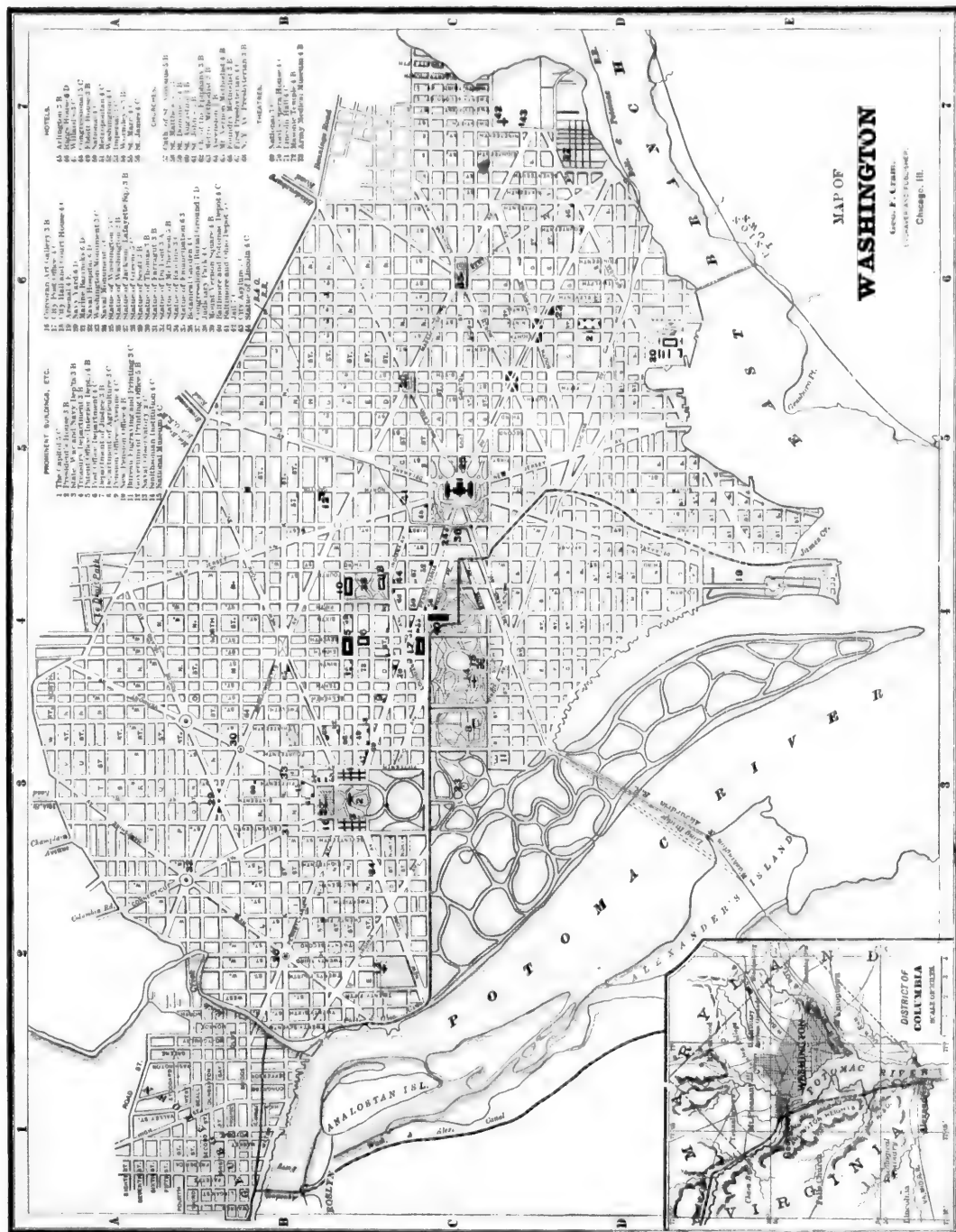






NEW
DRIVING MAP
OF
PHILADELPHIA

Geo. F. Crain,
ENGRAVER AND PUBLISHER,
Chicago, Ill.



CHICAGO

Geo. F. CYRUS,
ENGRAVER AND PUBLISHER,
Chicago, Ill.

REFERENCE TO FIGURES.

DEPOTS.

- 1 Chicago & Alton & D.
- 2 Chicago & Alton & D.
- 3 Chicago & Alton & D.
- 4 Chicago & Alton & D.
- 5 Chicago & Alton & D.
- 6 Chicago & Alton & D.
- 7 Chicago & Alton & D.
- 8 Chicago & Alton & D.
- 9 Chicago & Alton & D.
- 10 Chicago & Alton & D.
- 11 Chicago & Alton & D.
- 12 Chicago & Alton & D.
- 13 Chicago & Alton & D.
- 14 Chicago & Alton & D.
- 15 Chicago & Alton & D.
- 16 Chicago & Alton & D.
- 17 Chicago & Alton & D.
- 18 Chicago & Alton & D.
- 19 Chicago & Alton & D.
- 20 Chicago & Alton & D.
- 21 Chicago & Alton & D.
- 22 Chicago & Alton & D.
- 23 Chicago & Alton & D.
- 24 Chicago & Alton & D.
- 25 Chicago & Alton & D.
- 26 Chicago & Alton & D.
- 27 Chicago & Alton & D.
- 28 Chicago & Alton & D.
- 29 Chicago & Alton & D.
- 30 Chicago & Alton & D.
- 31 Chicago & Alton & D.
- 32 Chicago & Alton & D.
- 33 Chicago & Alton & D.
- 34 Chicago & Alton & D.
- 35 Chicago & Alton & D.
- 36 Chicago & Alton & D.
- 37 Chicago & Alton & D.
- 38 Chicago & Alton & D.
- 39 Chicago & Alton & D.
- 40 Chicago & Alton & D.
- 41 Chicago & Alton & D.
- 42 Chicago & Alton & D.
- 43 Chicago & Alton & D.
- 44 Chicago & Alton & D.
- 45 Chicago & Alton & D.
- 46 Chicago & Alton & D.
- 47 Chicago & Alton & D.
- 48 Chicago & Alton & D.
- 49 Chicago & Alton & D.
- 50 Chicago & Alton & D.
- 51 Chicago & Alton & D.
- 52 Chicago & Alton & D.
- 53 Chicago & Alton & D.
- 54 Chicago & Alton & D.
- 55 Chicago & Alton & D.
- 56 Chicago & Alton & D.
- 57 Chicago & Alton & D.
- 58 Chicago & Alton & D.
- 59 Chicago & Alton & D.
- 60 Chicago & Alton & D.
- 61 Chicago & Alton & D.
- 62 Chicago & Alton & D.
- 63 Chicago & Alton & D.
- 64 Chicago & Alton & D.
- 65 Chicago & Alton & D.
- 66 Chicago & Alton & D.
- 67 Chicago & Alton & D.
- 68 Chicago & Alton & D.
- 69 Chicago & Alton & D.
- 70 Chicago & Alton & D.
- 71 Chicago & Alton & D.
- 72 Chicago & Alton & D.
- 73 Chicago & Alton & D.
- 74 Chicago & Alton & D.
- 75 Chicago & Alton & D.
- 76 Chicago & Alton & D.
- 77 Chicago & Alton & D.
- 78 Chicago & Alton & D.
- 79 Chicago & Alton & D.
- 80 Chicago & Alton & D.
- 81 Chicago & Alton & D.
- 82 Chicago & Alton & D.
- 83 Chicago & Alton & D.
- 84 Chicago & Alton & D.
- 85 Chicago & Alton & D.
- 86 Chicago & Alton & D.
- 87 Chicago & Alton & D.
- 88 Chicago & Alton & D.
- 89 Chicago & Alton & D.
- 90 Chicago & Alton & D.
- 91 Chicago & Alton & D.
- 92 Chicago & Alton & D.
- 93 Chicago & Alton & D.
- 94 Chicago & Alton & D.
- 95 Chicago & Alton & D.
- 96 Chicago & Alton & D.
- 97 Chicago & Alton & D.
- 98 Chicago & Alton & D.
- 99 Chicago & Alton & D.
- 100 Chicago & Alton & D.

- 8 Union Station & E.
- 9 Union Station & E.
- 10 Union Station & E.
- 11 Union Station & E.

SOME OF THE PRINCIPAL HOTELS.

- 1 Palmer House & E.
- 2 Grand Pacific & E.
- 3 Sherman & E.
- 4 Commercial & E.
- 5 Tremont & E.
- 6 Village & E.
- 7 Ogden & E.
- 8 Union & E.
- 9 Crawford & E.
- 10 Baltimore & E.
- 11 Leland & E.

Steam Roads

Horse Roads

Light House

Light House

Light House

Light House

Light House

Light House

Light House

Light House

Light House

Light House

Light House

Light House

Light House

Light House

Light House

Light House

Light House

Light House

Light House

Light House

Light House

Light House

Light House

Light House

Light House

Light House

Light House

Light House

Light House

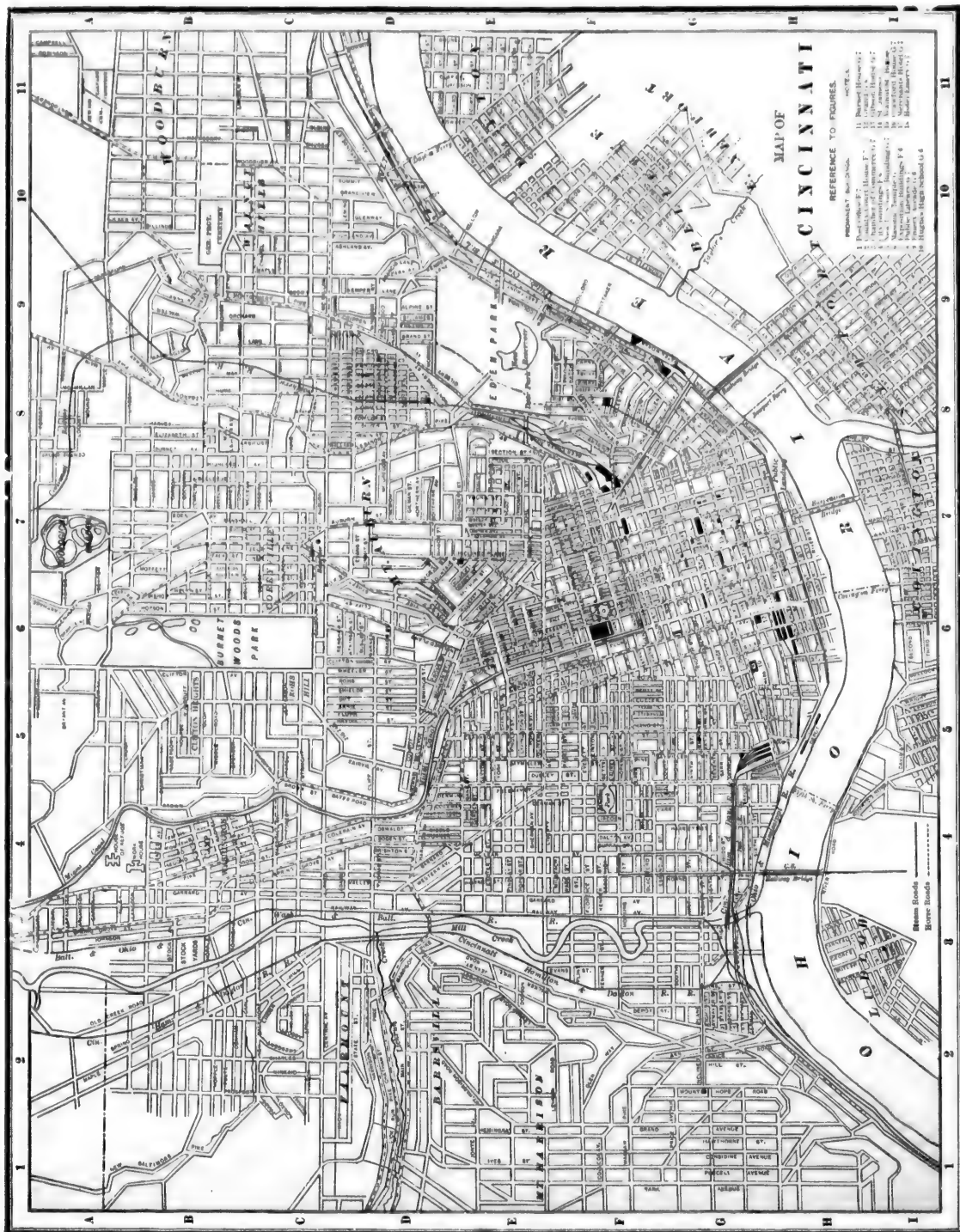
Light House

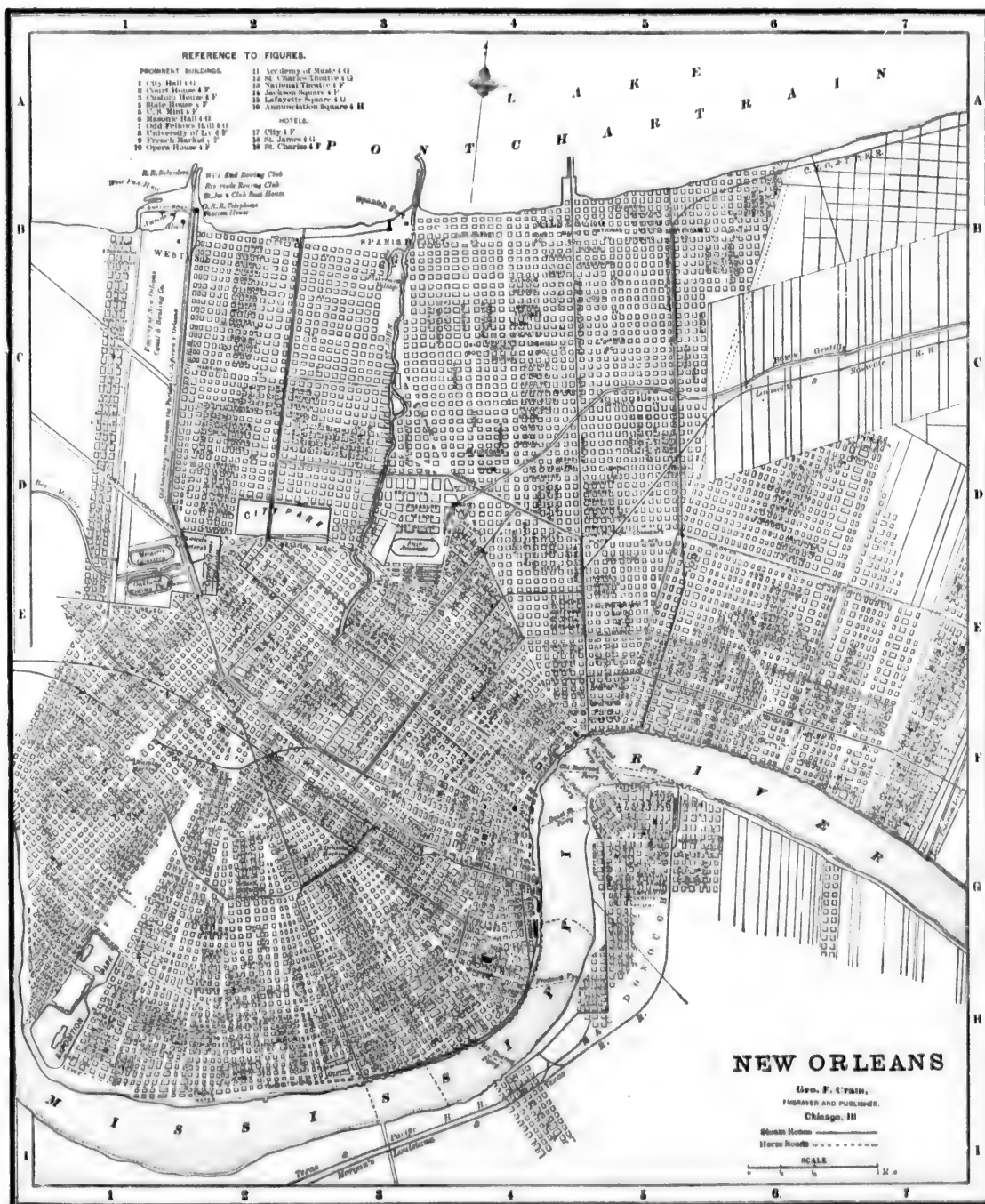
Light House

Light House

Light House

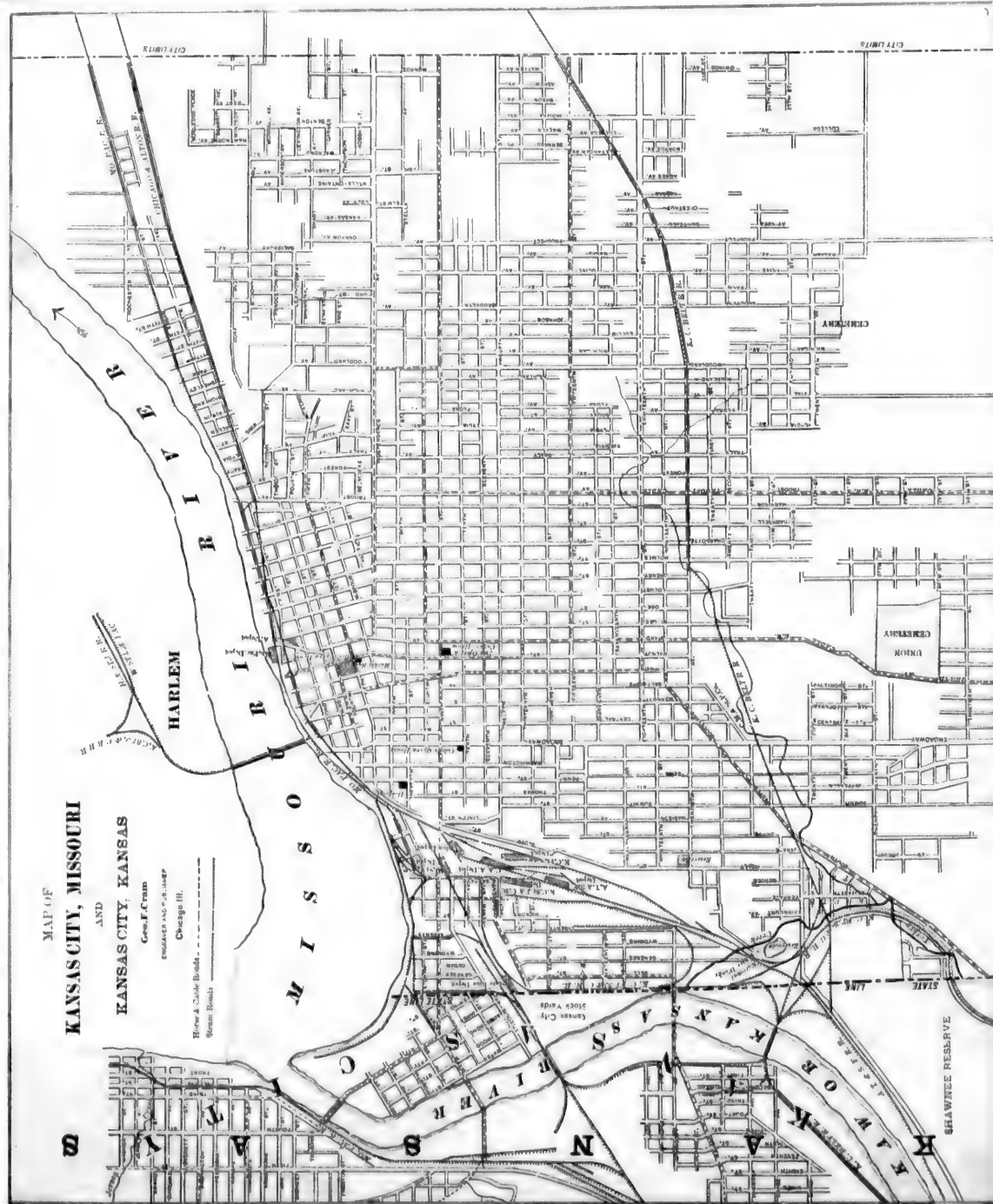


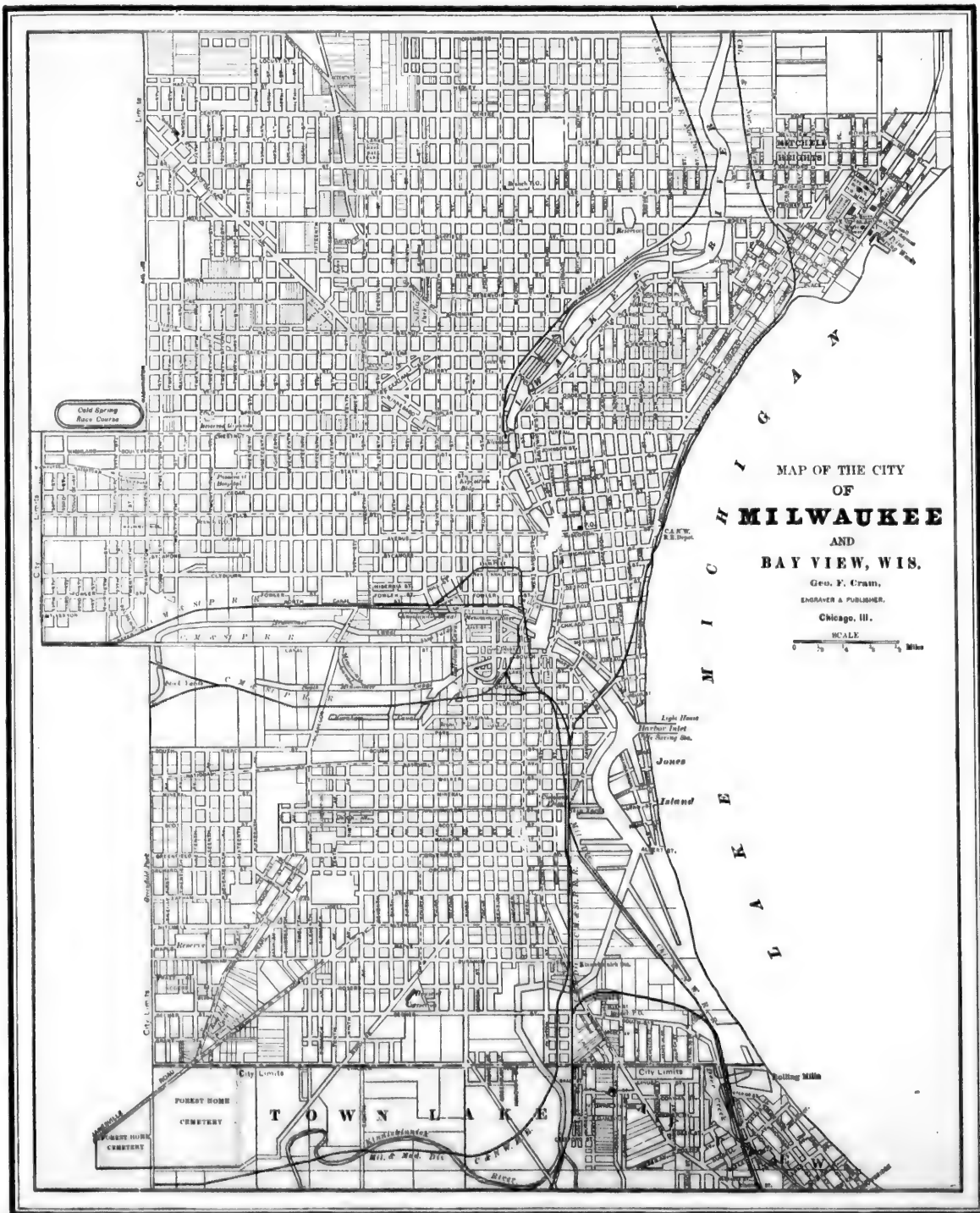




MAP OF
KANSAS CITY, MISSOURI
AND
KANSAS CITY, KANSAS

Geo. F. Crum
ENGINEER AND P.L.S.
Chicago Ill.
Horse & Cattle Roads
Steam Roads





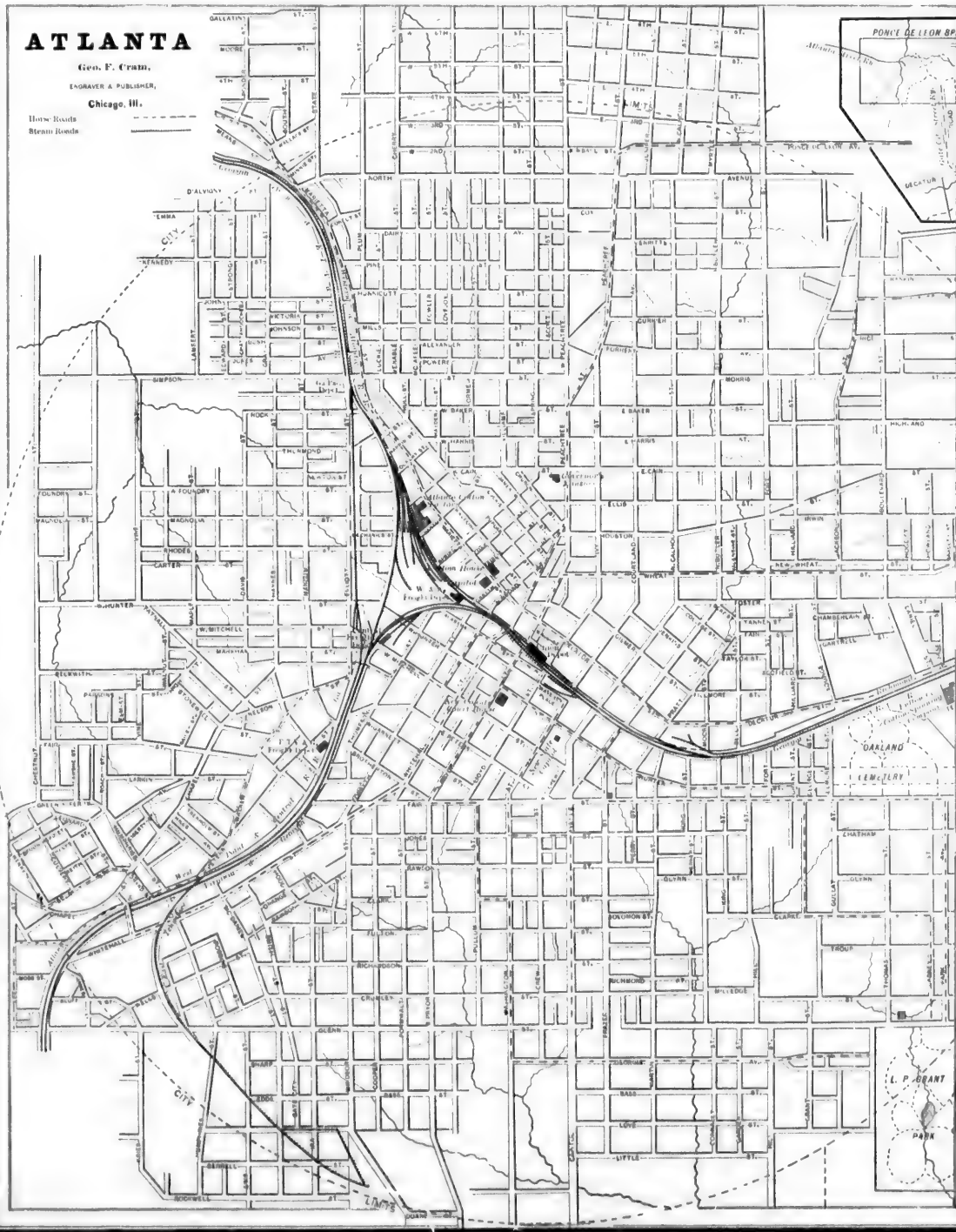
ATLANTA

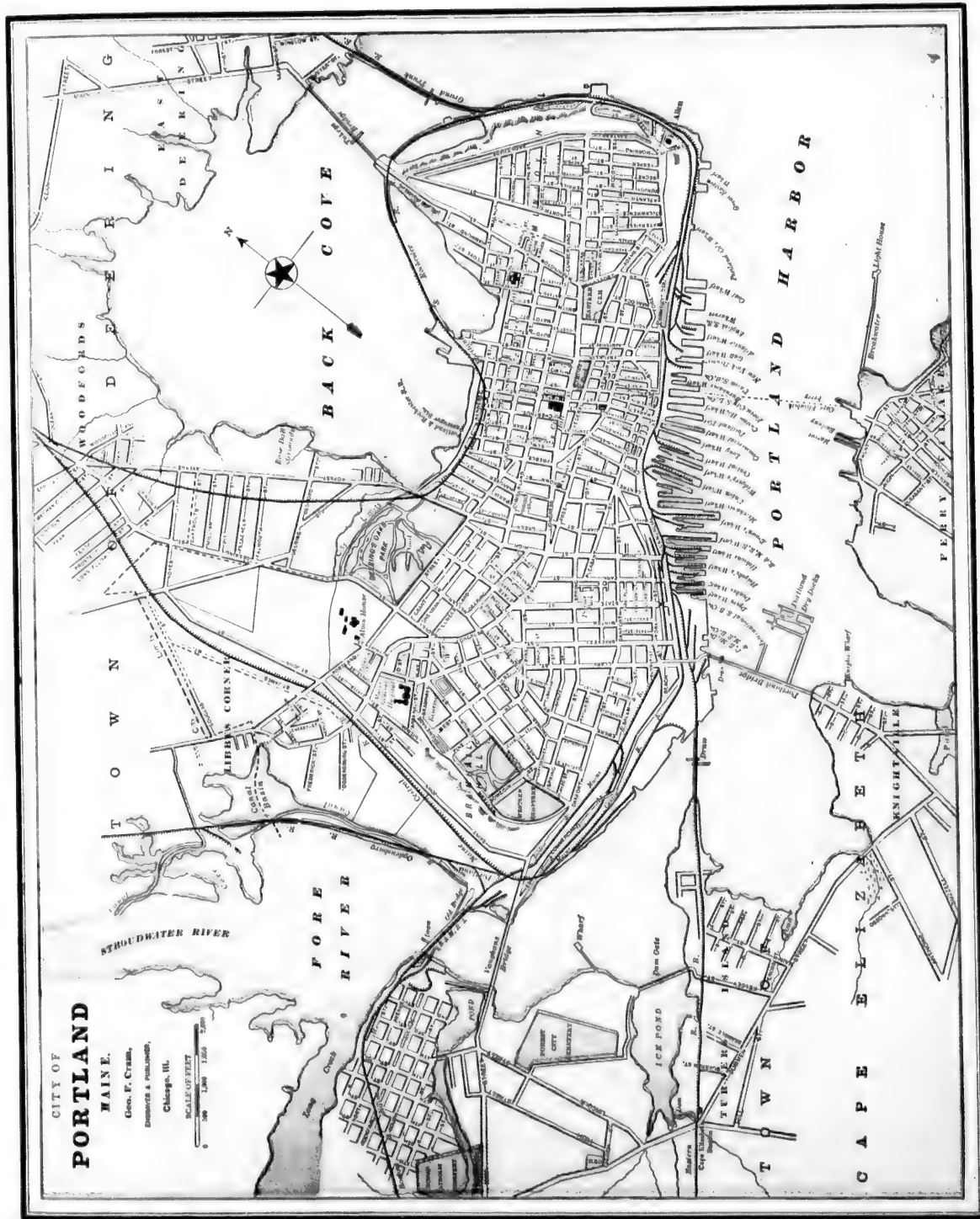
Geo. F. Cram,

ENGRAVER & PUBLISHER,

Chicago, Ill.

Howe Roads
Steam Roads

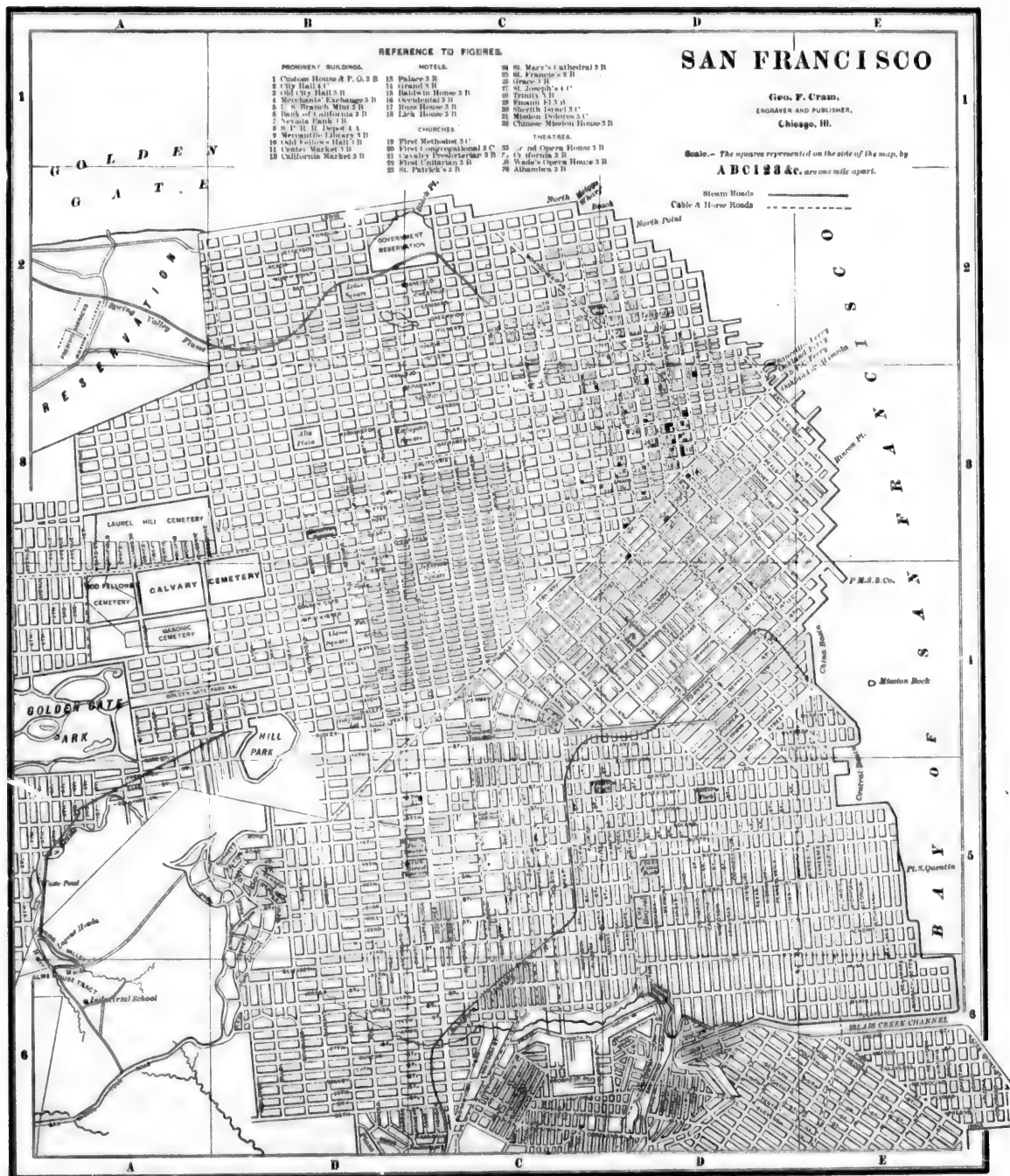


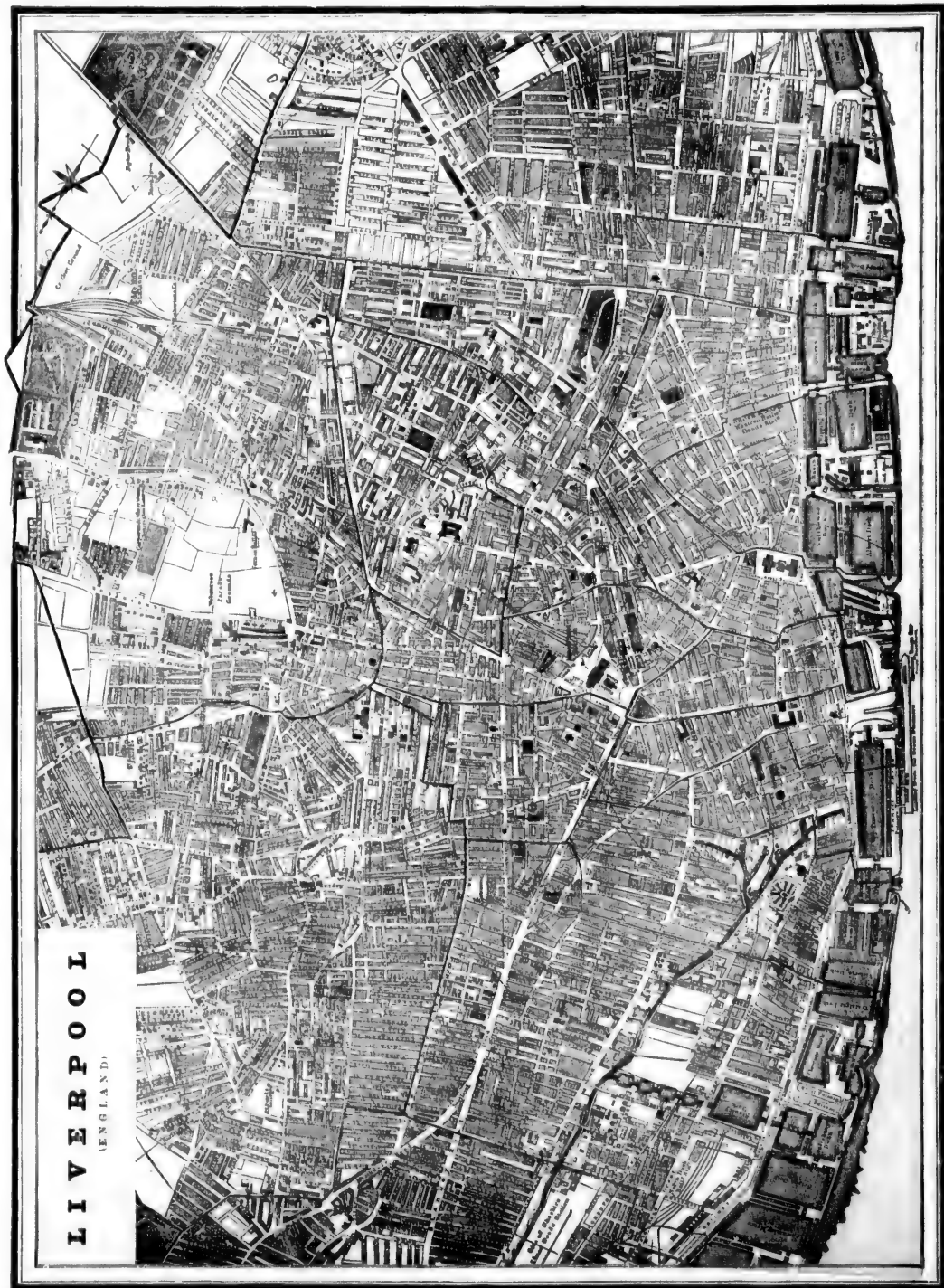


CITY OF
PORTLAND

MAINE.
Geo. F. Cram,
Surveyor & Publisher,
Chicago, Ill.

SCALE OF FEET
0 500 1,000 1,500 2,000



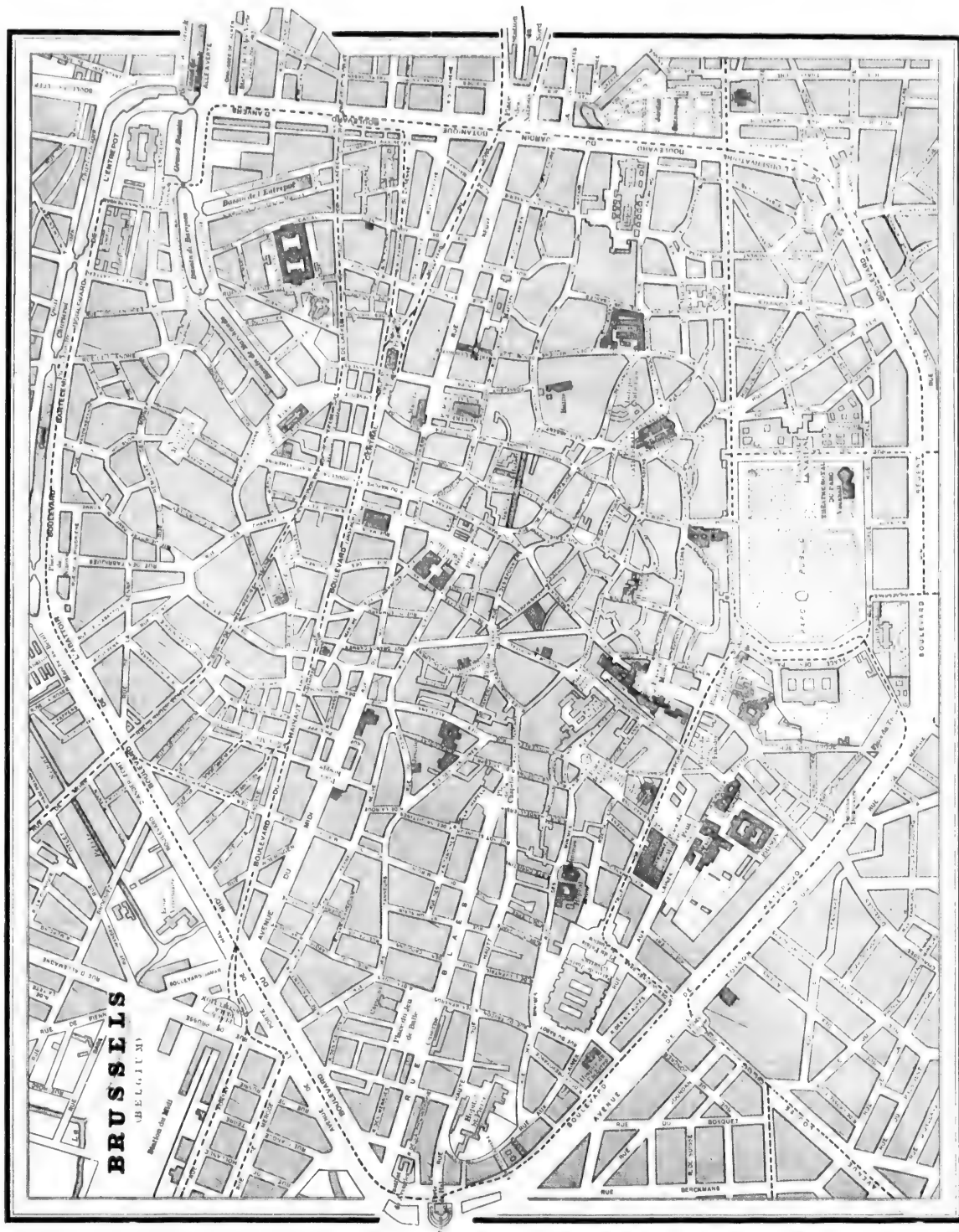


LONDON

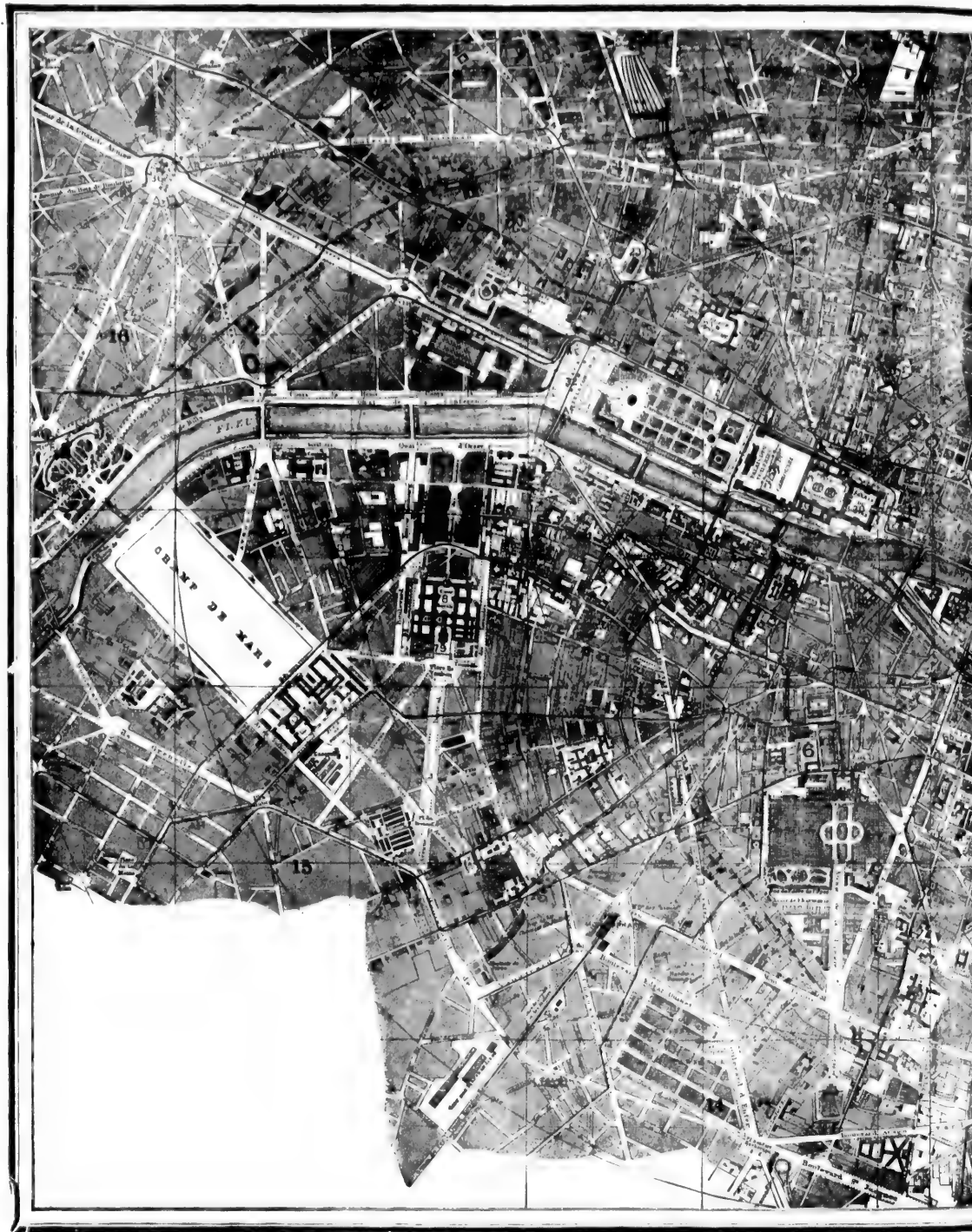
(ENGLAND)









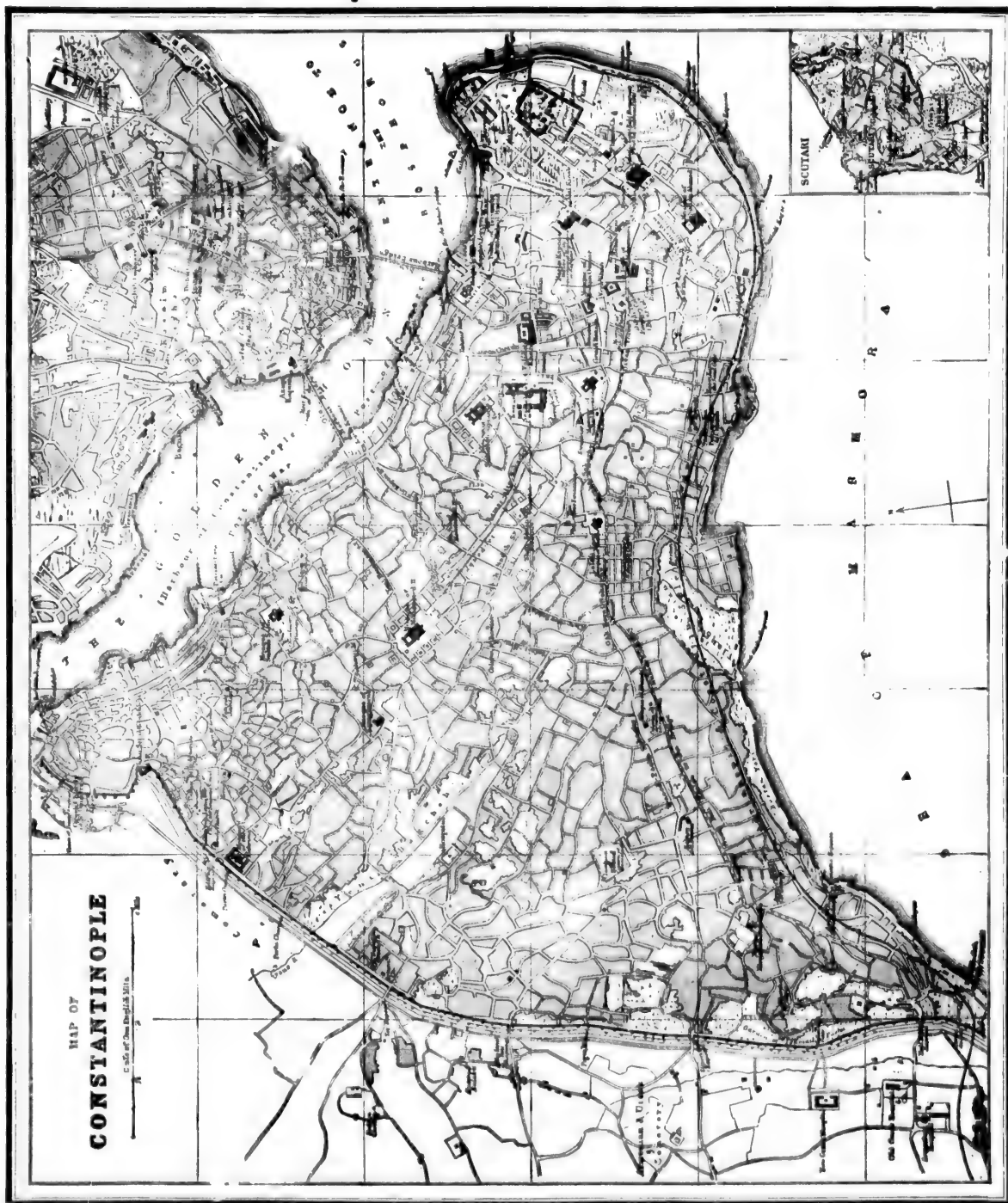


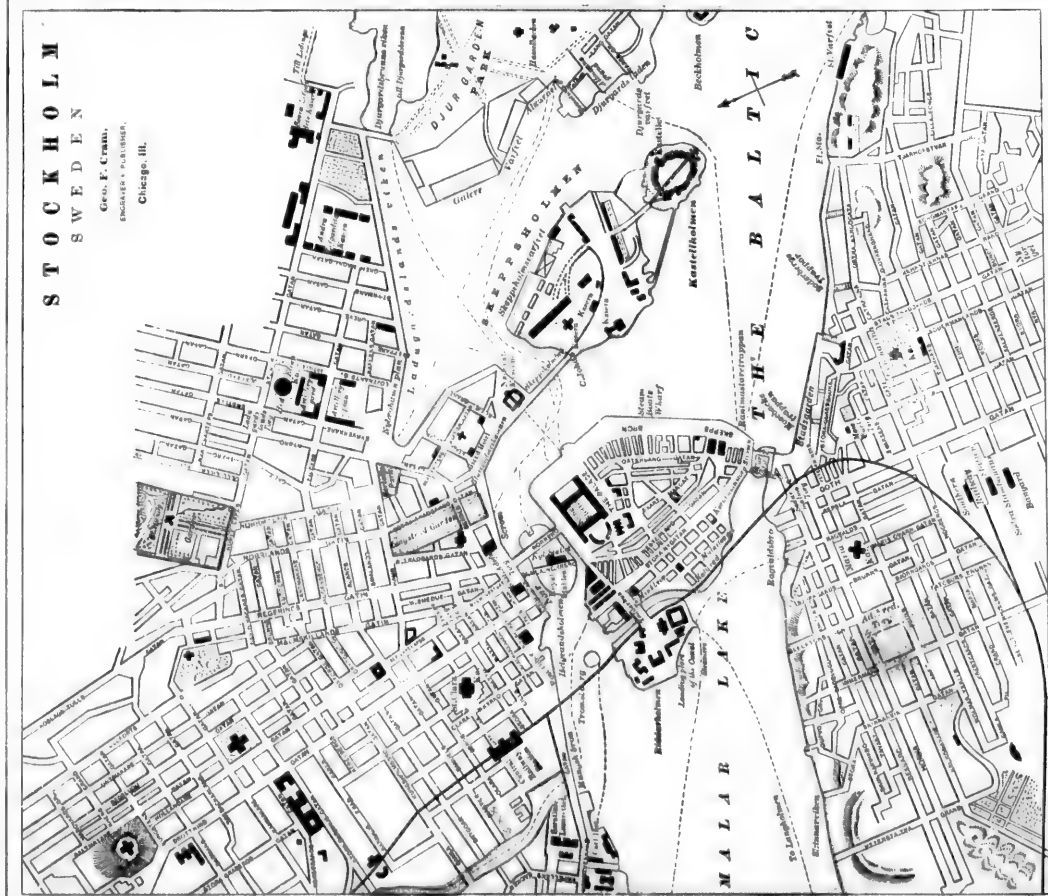
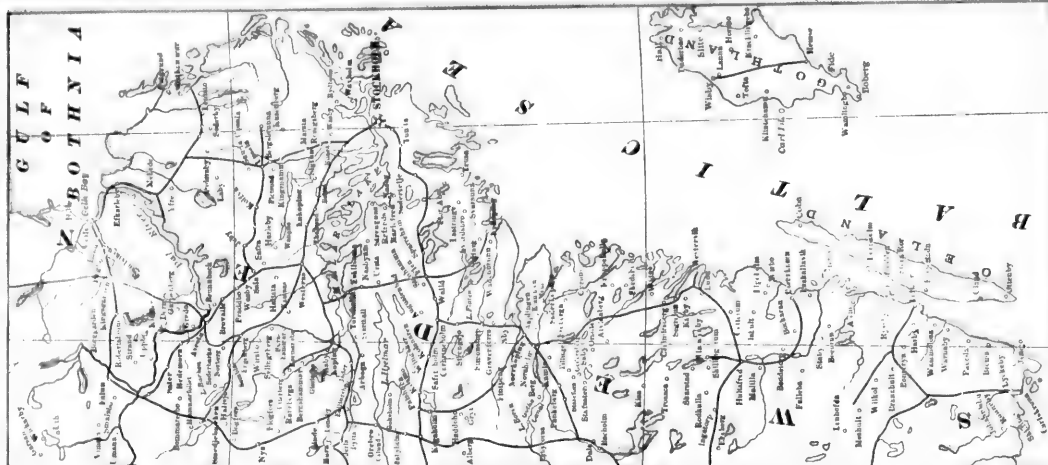
[illegible]

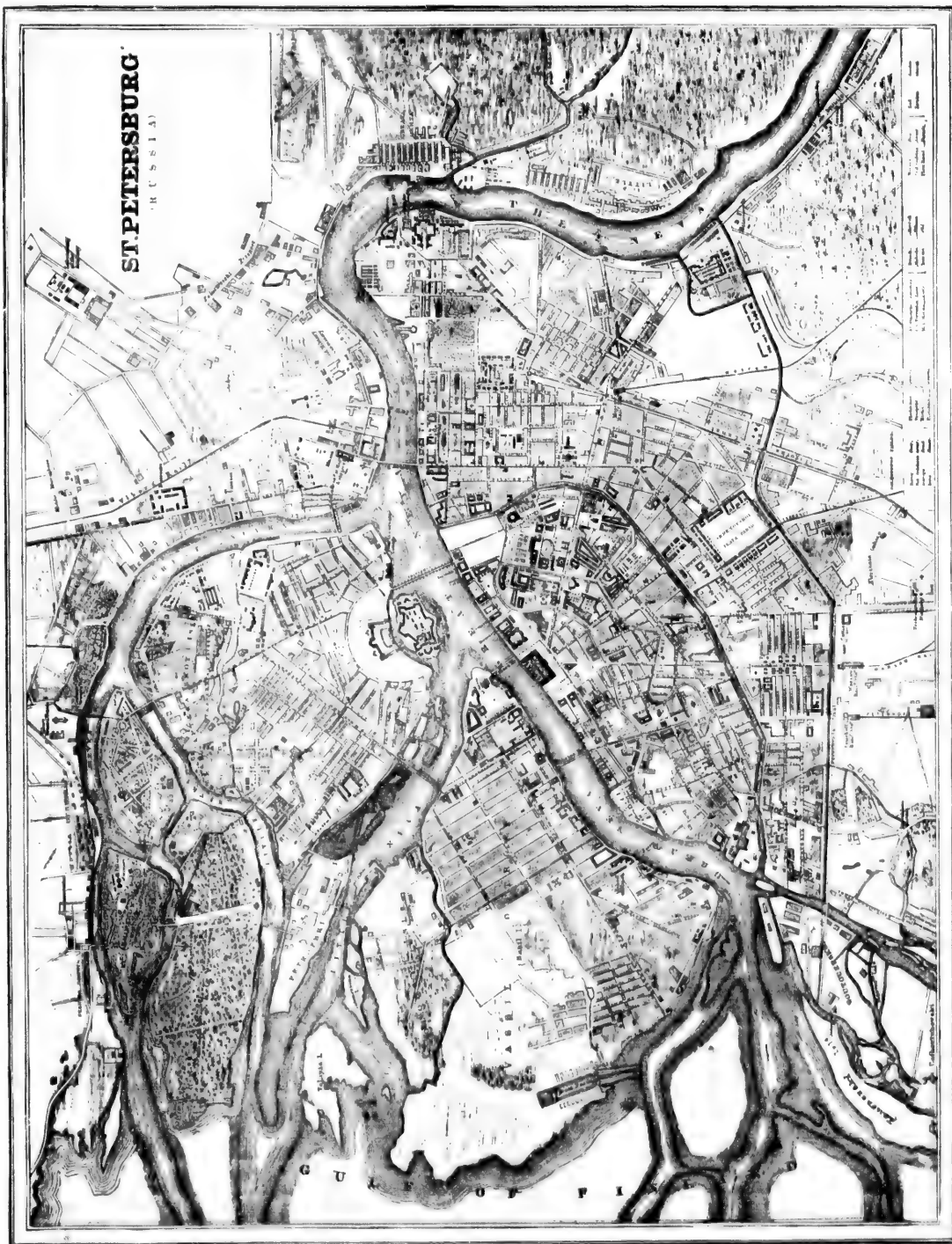


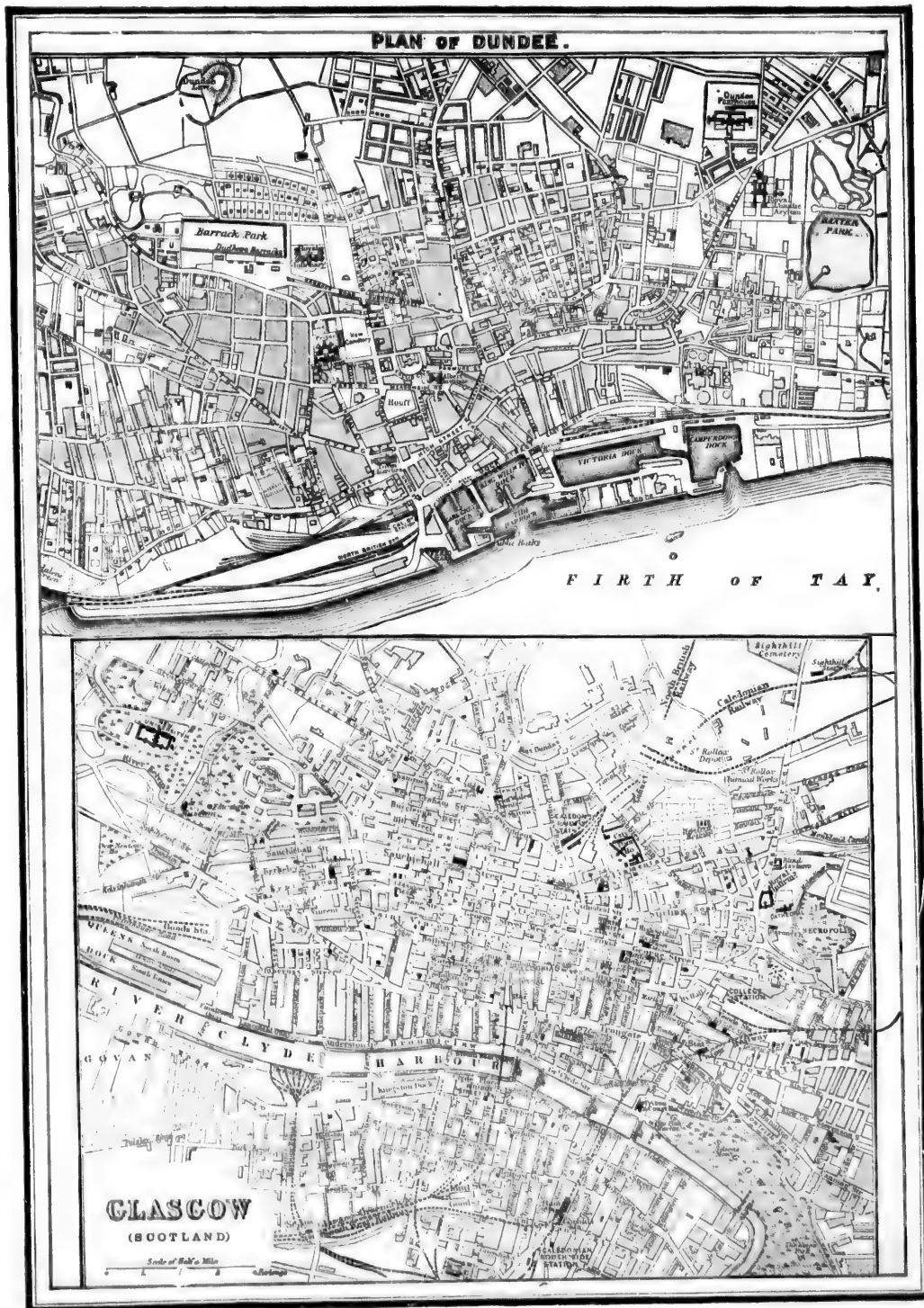
CALCUTTA

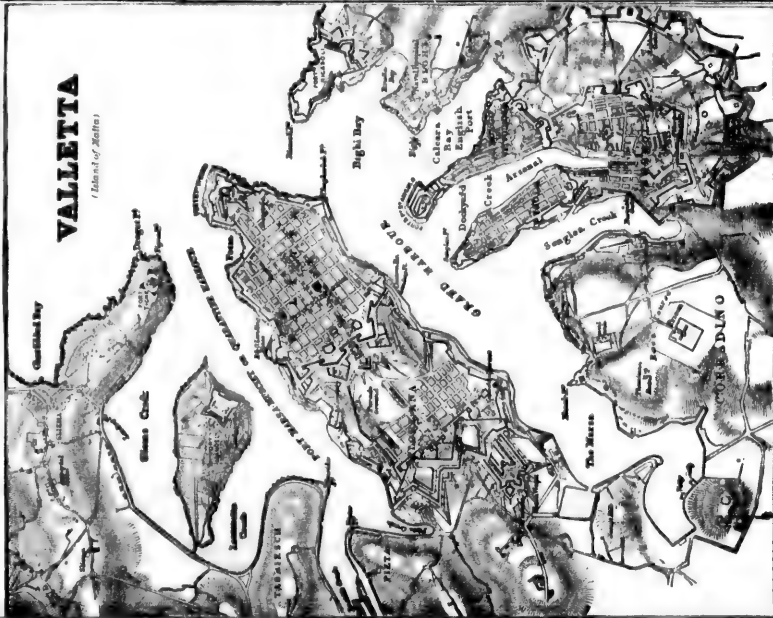
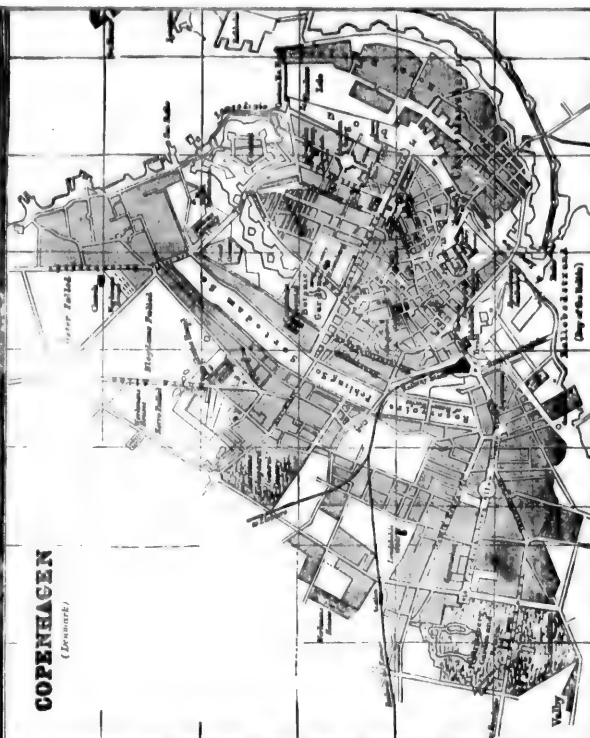
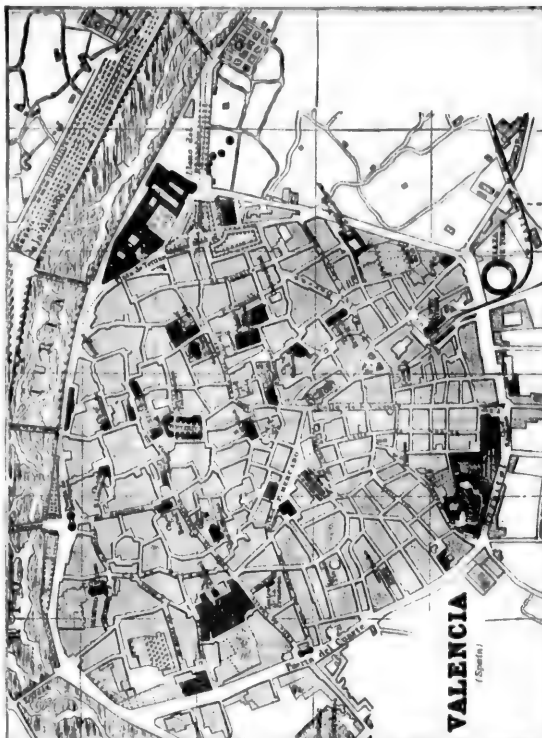
(INDIA)





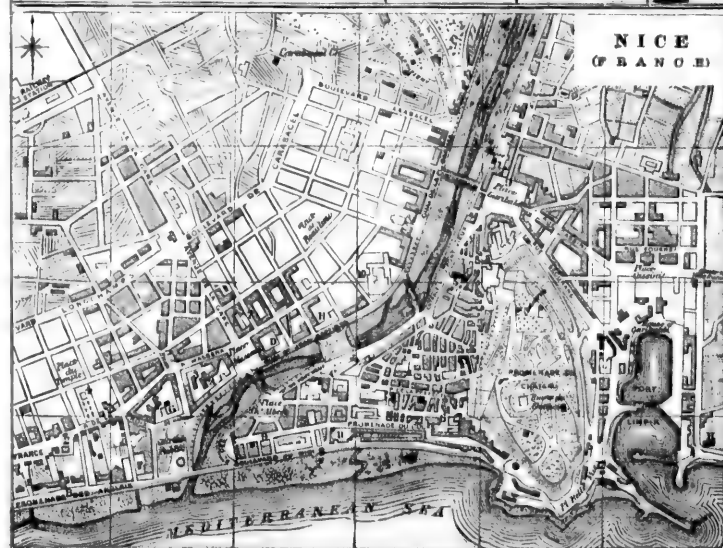








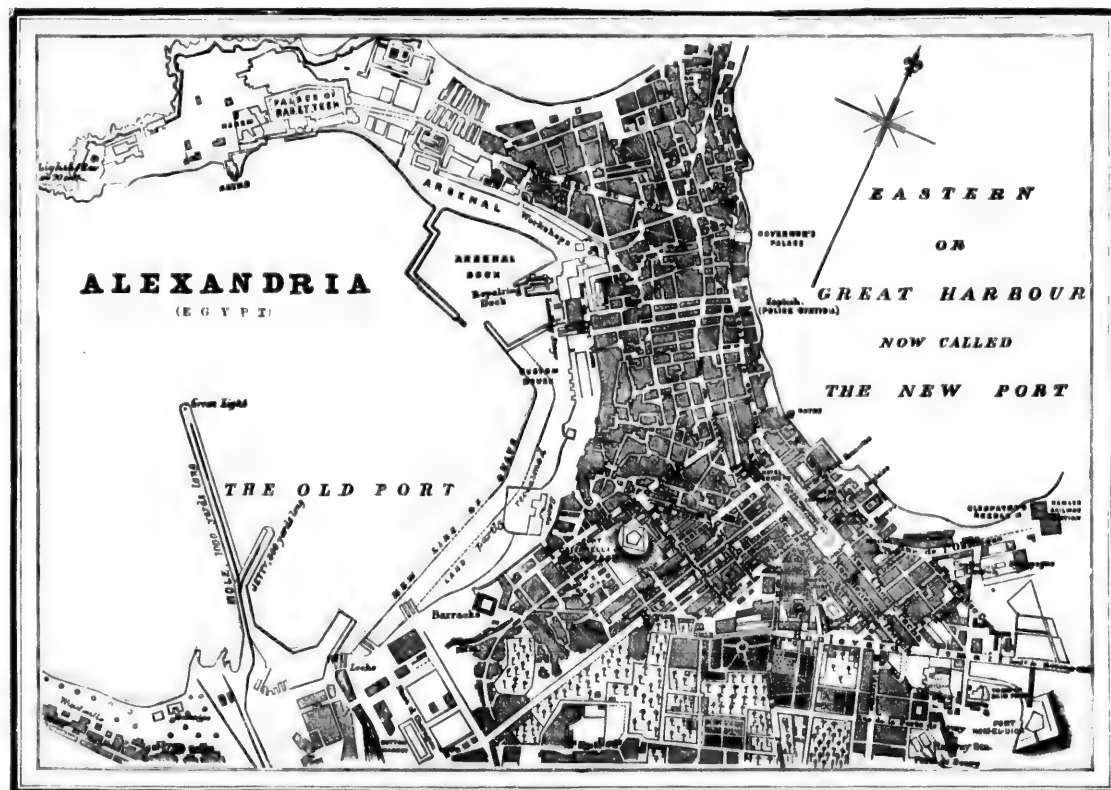
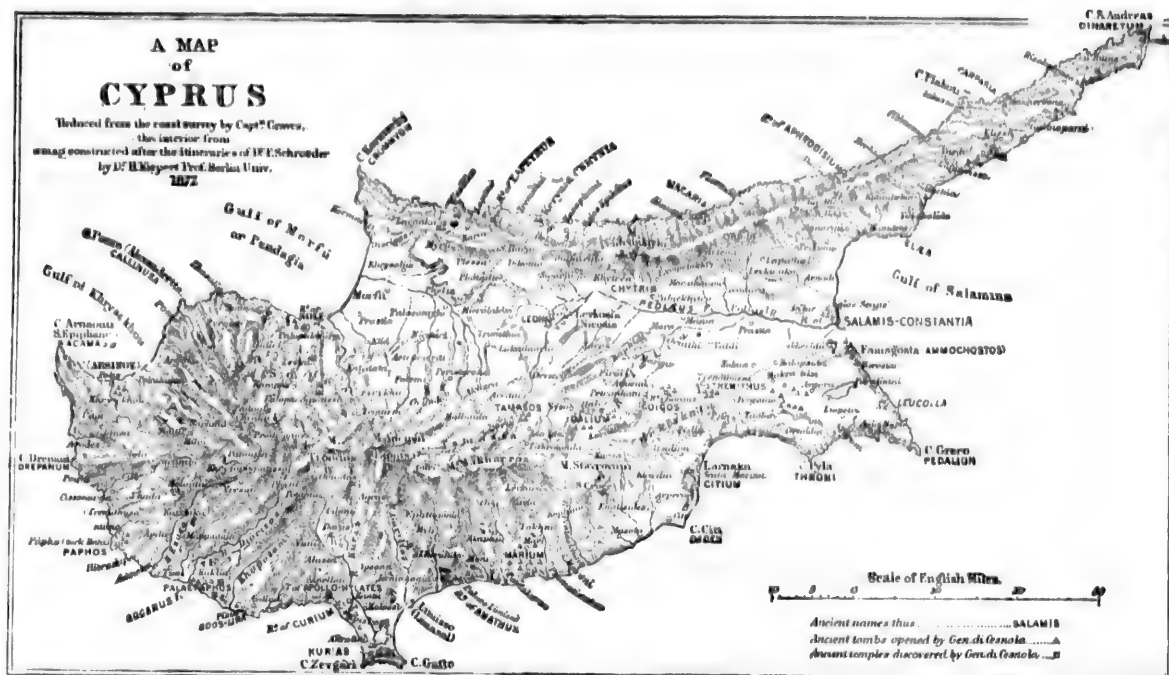
MARSEILLES
(FRANCE)

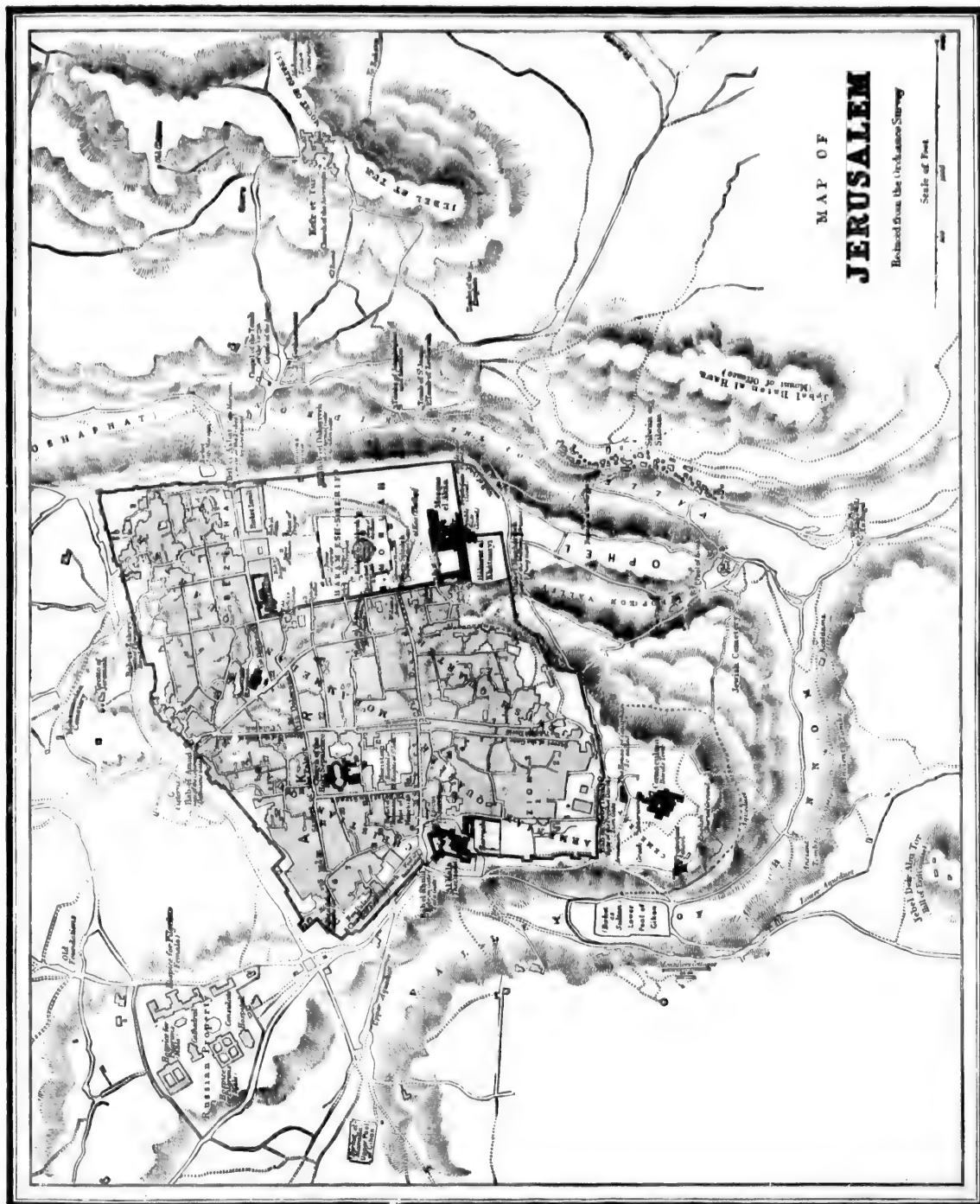


NICE
(FRANCE)



CORSICA
(To France)





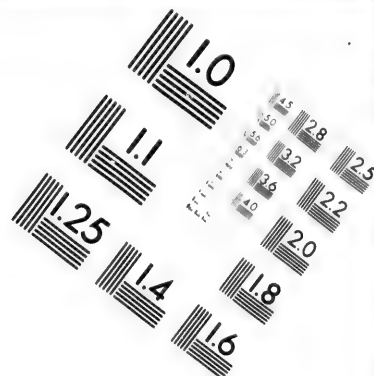
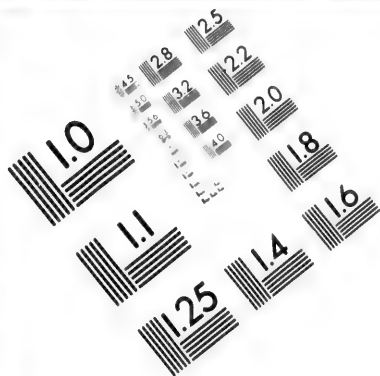
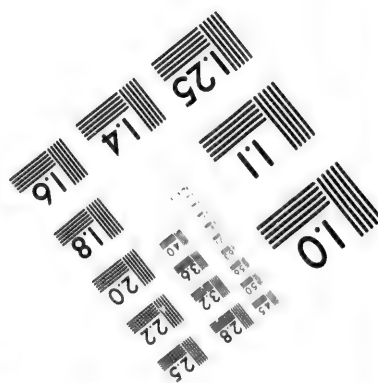
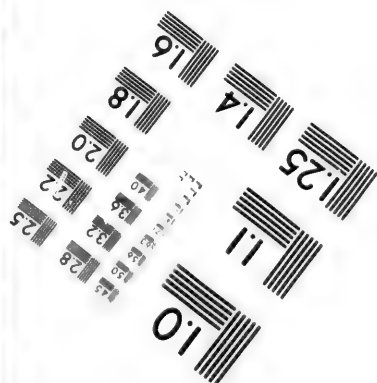
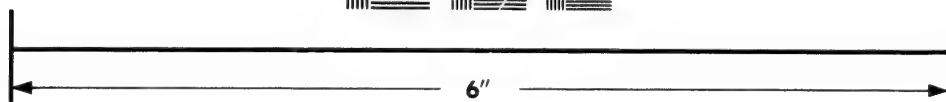
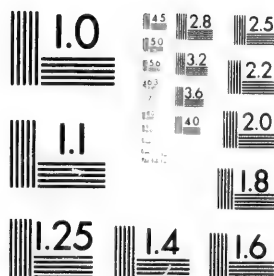


IMAGE EVALUATION TEST TARGET (MT-3)

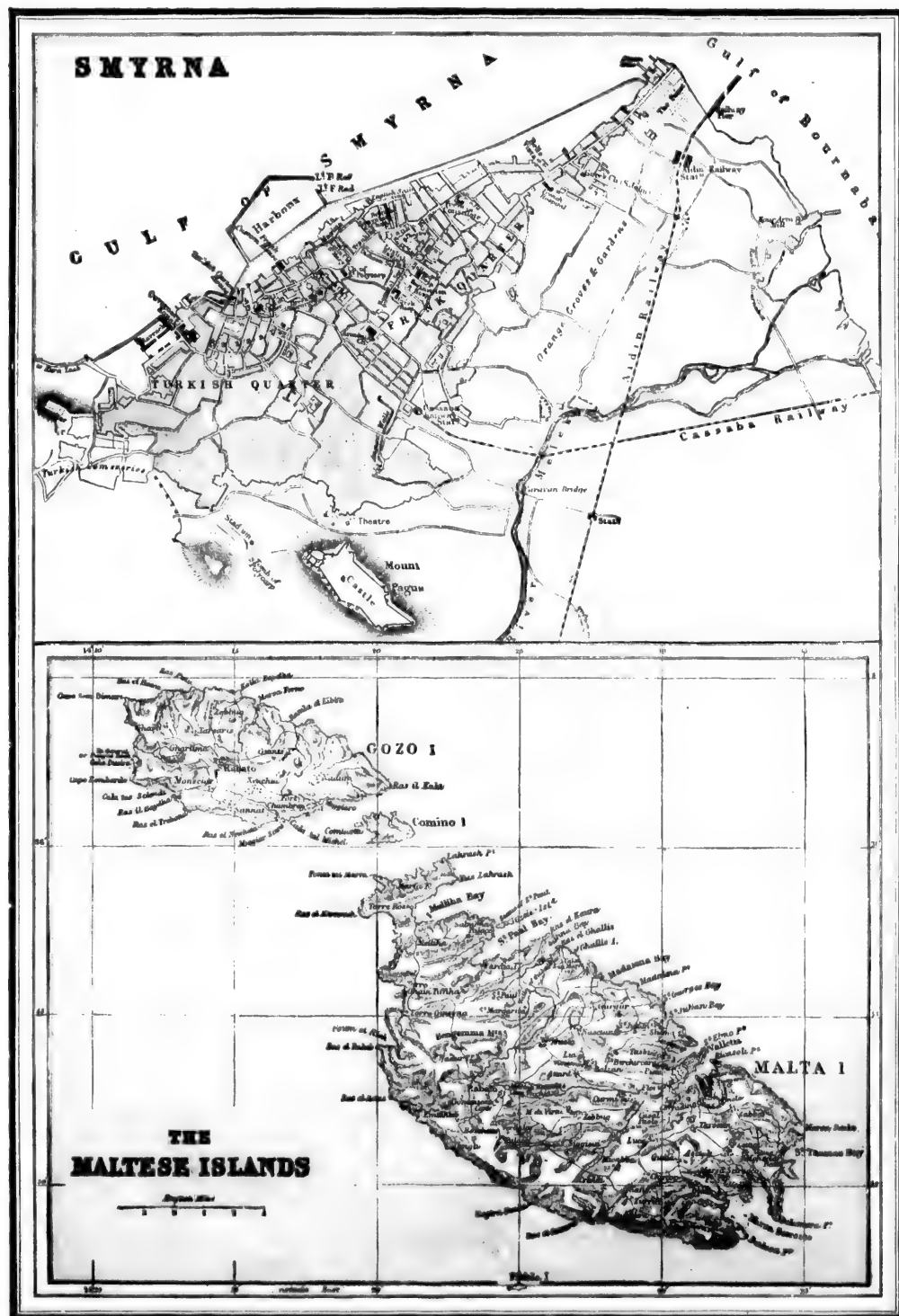


Photographic
Sciences
Corporation

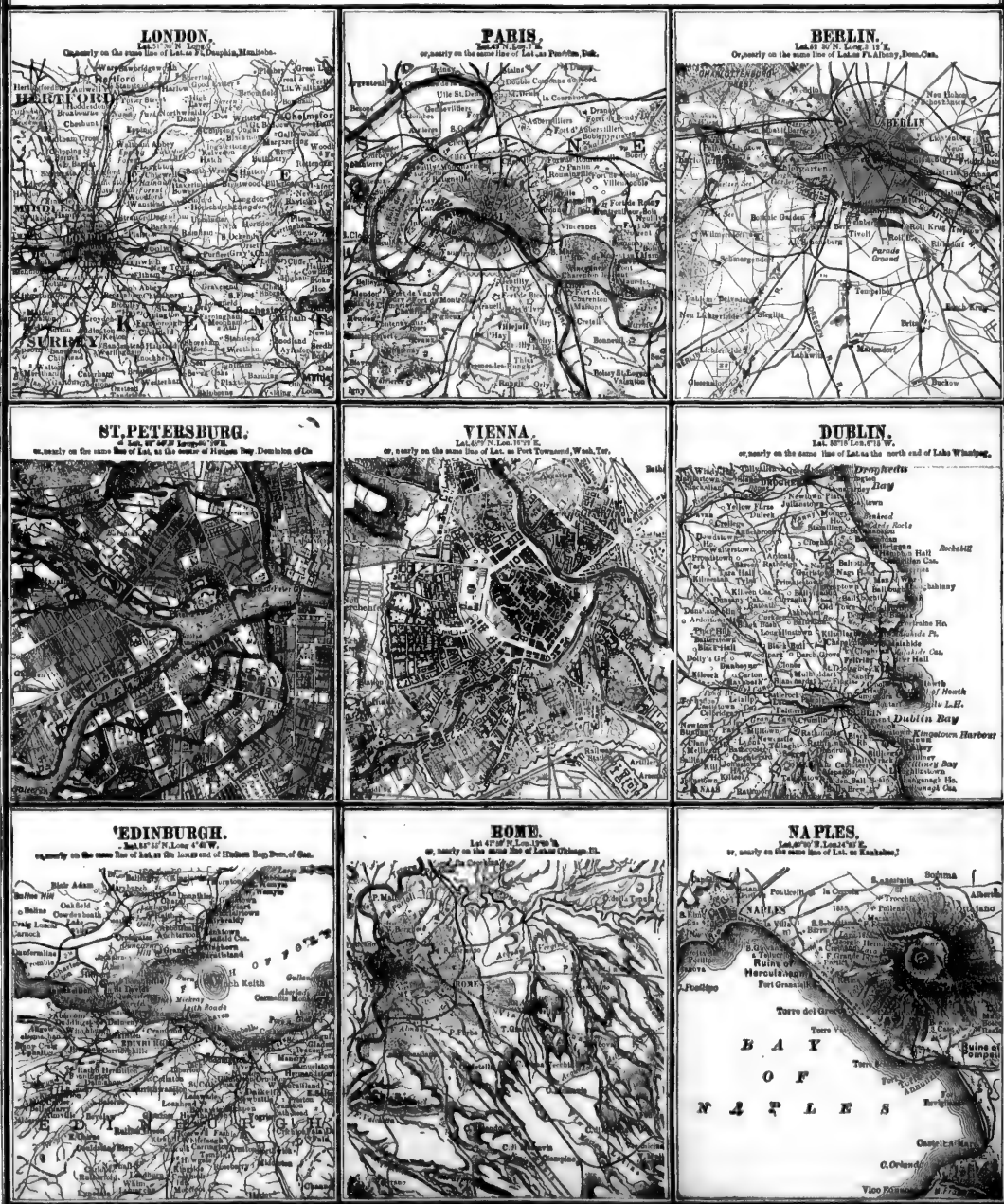
23 WEST MAIN STREET
WEBSTER, N.Y. 14580
(716) 872-4503

1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
8.5
9.0
9.5
10.0
10.5
11.0
11.5
12.0
12.5
13.0
13.5
14.0
14.5
15.0
15.5
16.0
16.5
17.0
17.5
18.0
18.5
19.0
19.5
20.0
20.5
21.0
21.5
22.0
22.5
23.0
23.5
24.0
24.5
25.0
25.5
26.0
26.5
27.0
27.5
28.0
28.5
29.0
29.5
30.0
30.5
31.0
31.5
32.0
32.5
33.0
33.5
34.0
34.5
35.0
35.5
36.0
36.5
37.0
37.5
38.0
38.5
39.0
39.5
40.0
40.5
41.0
41.5
42.0
42.5
43.0
43.5
44.0
44.5
45.0
45.5
46.0
46.5
47.0
47.5
48.0
48.5
49.0
49.5
50.0
50.5
51.0
51.5
52.0
52.5
53.0
53.5
54.0
54.5
55.0
55.5
56.0
56.5
57.0
57.5
58.0
58.5
59.0
59.5
60.0
60.5
61.0
61.5
62.0
62.5
63.0
63.5
64.0
64.5
65.0
65.5
66.0
66.5
67.0
67.5
68.0
68.5
69.0
69.5
70.0
70.5
71.0
71.5
72.0
72.5
73.0
73.5
74.0
74.5
75.0
75.5
76.0
76.5
77.0
77.5
78.0
78.5
79.0
79.5
80.0
80.5
81.0
81.5
82.0
82.5
83.0
83.5
84.0
84.5
85.0
85.5
86.0
86.5
87.0
87.5
88.0
88.5
89.0
89.5
90.0
90.5
91.0
91.5
92.0
92.5
93.0
93.5
94.0
94.5
95.0
95.5
96.0
96.5
97.0
97.5
98.0
98.5
99.0
99.5
100.0

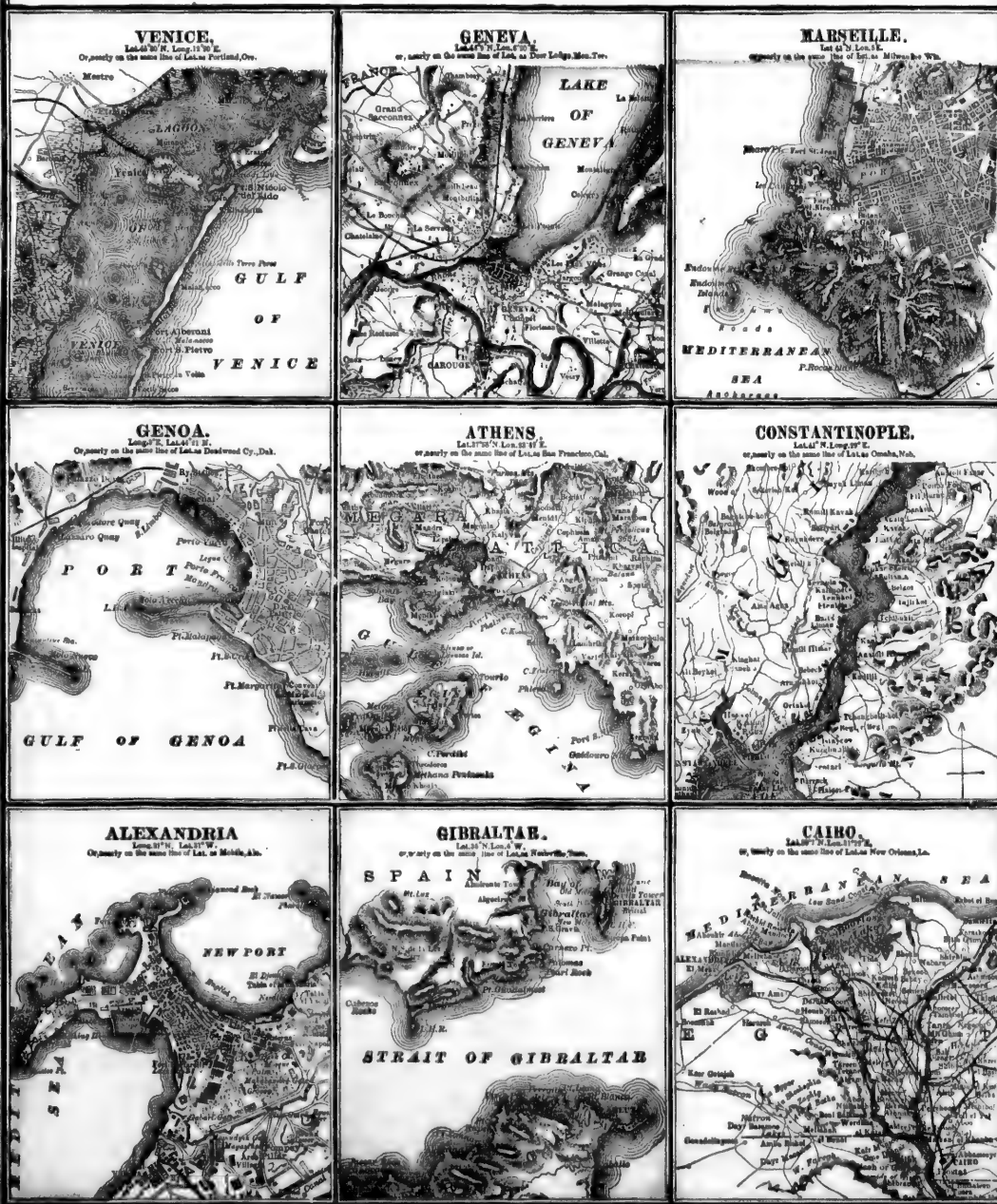
10

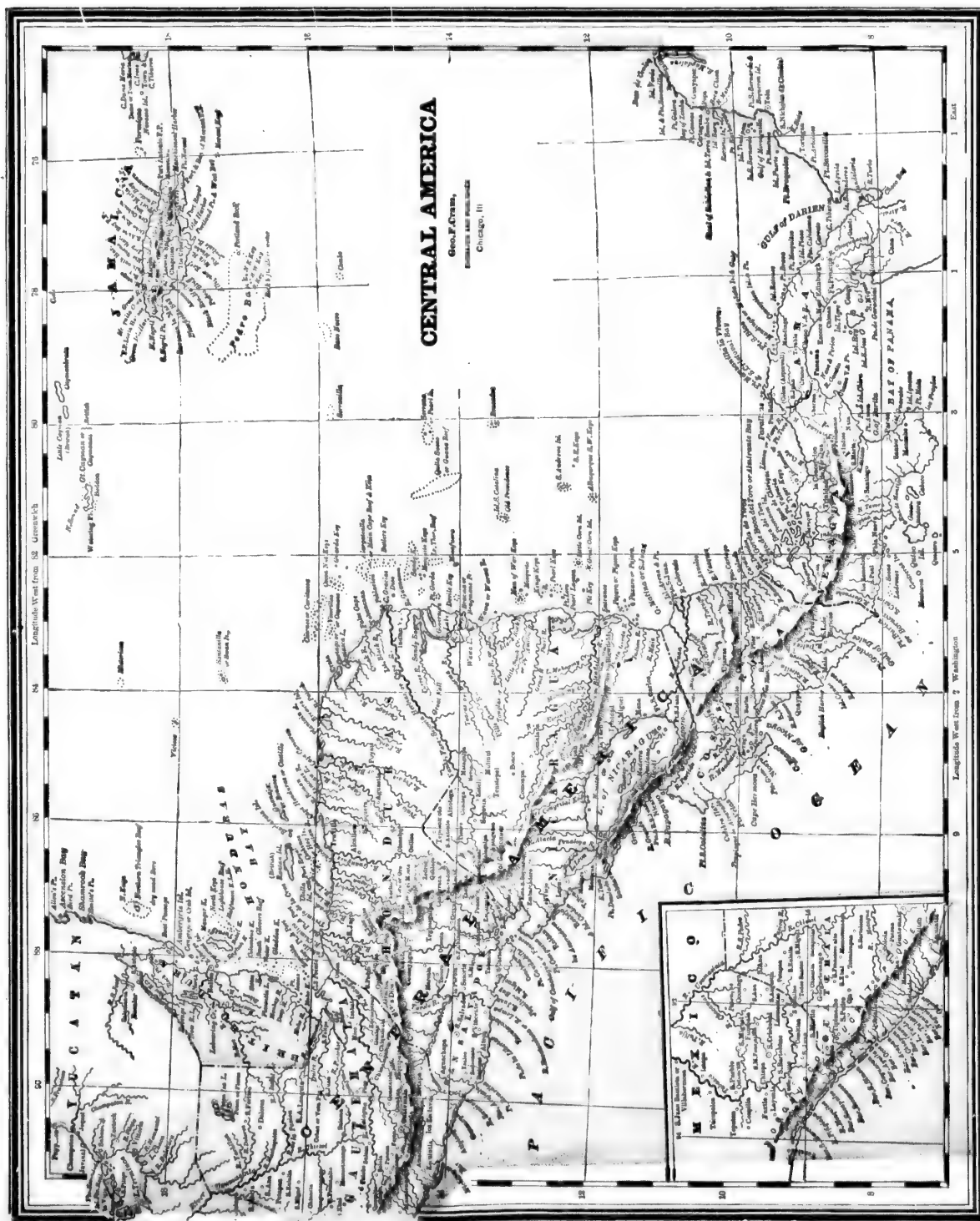


PRINCIPAL CITIES OF THE OLD WORLD, COMPARING THEIR LATITUDE WITH POINTS ON THE AMERICAN CONTINENT.

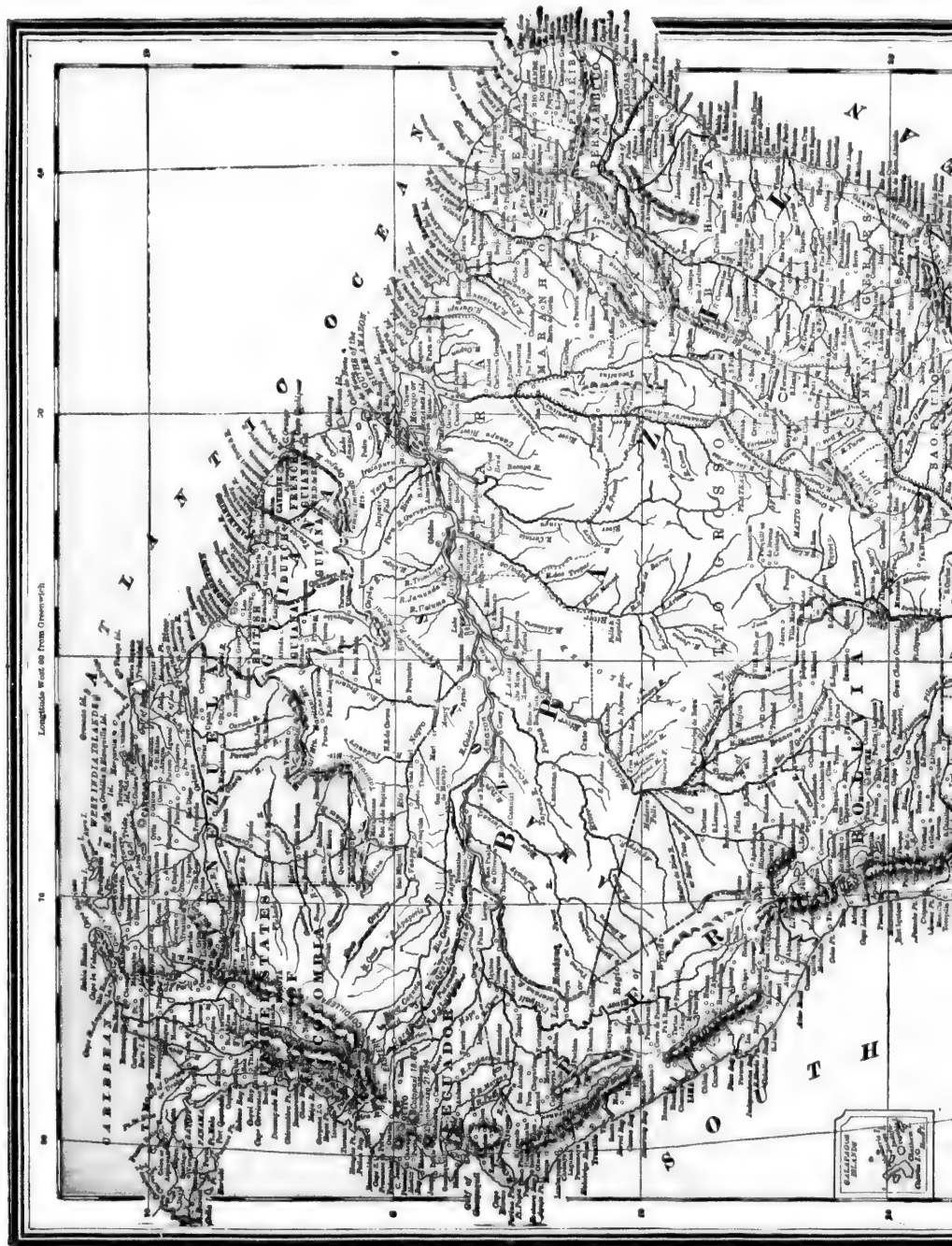


PRINCIPAL CITIES OF THE OLD WORLD, COMPARING THEIR LATITUDE WITH POINTS ON THE AMERICAN CONTINENT.

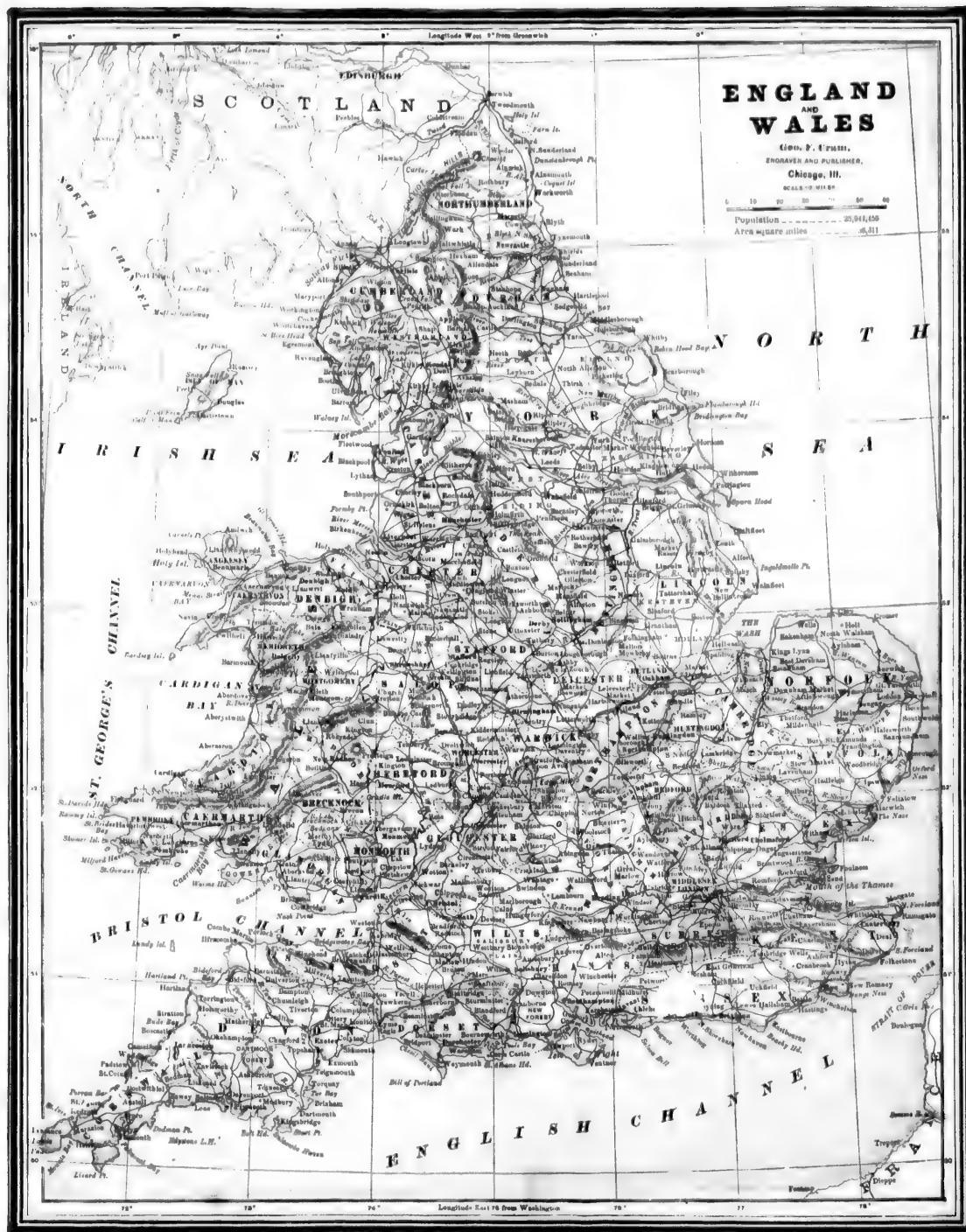


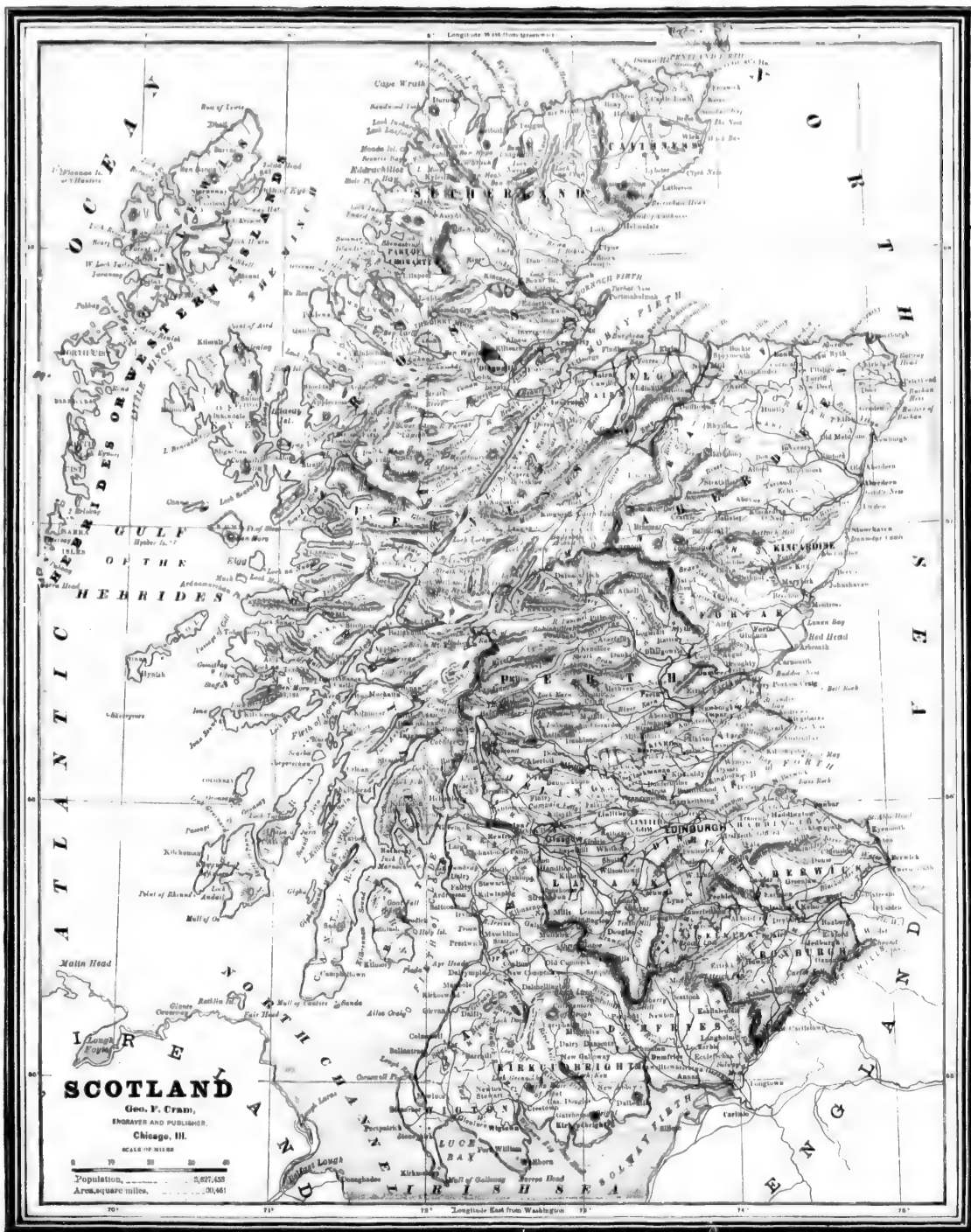


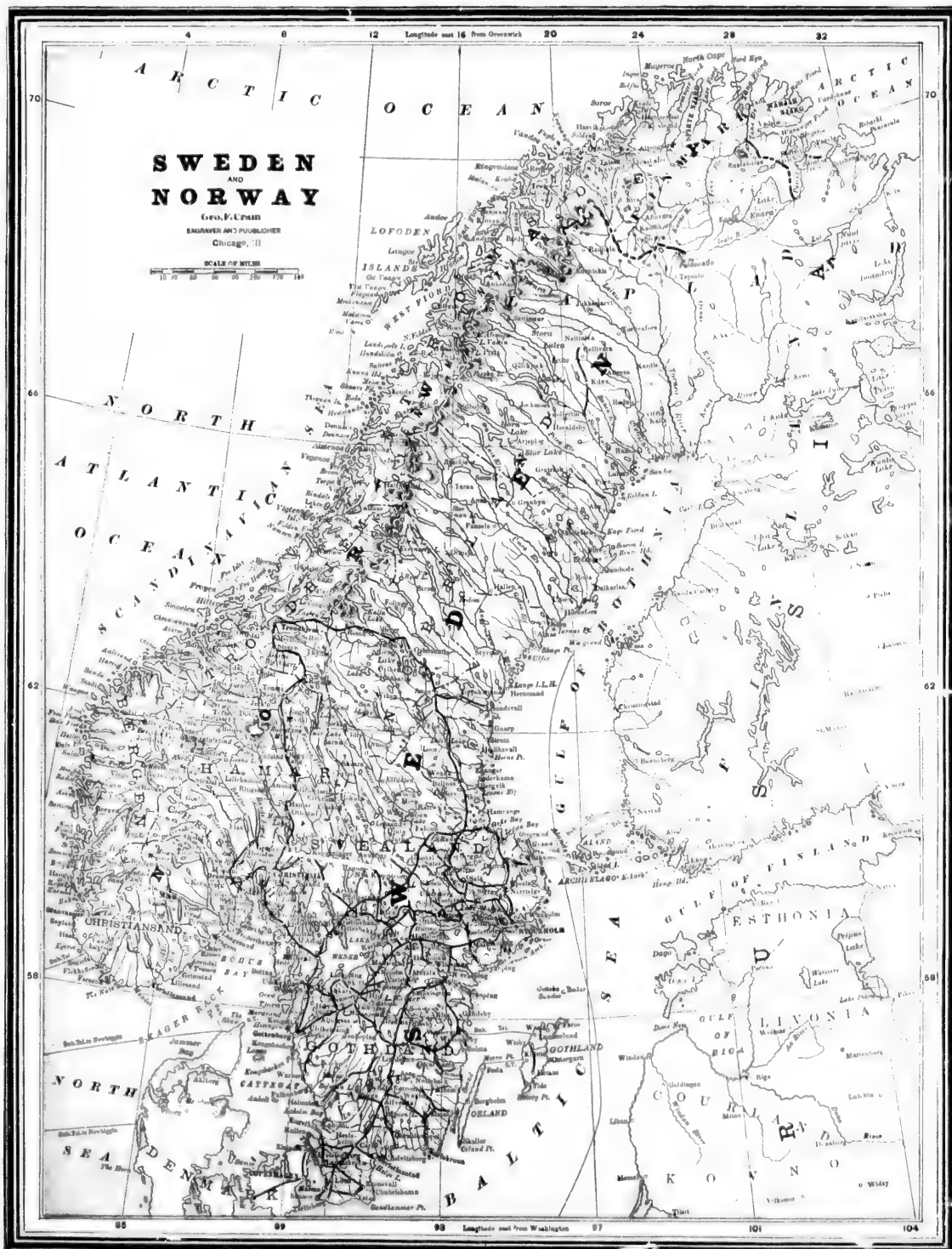


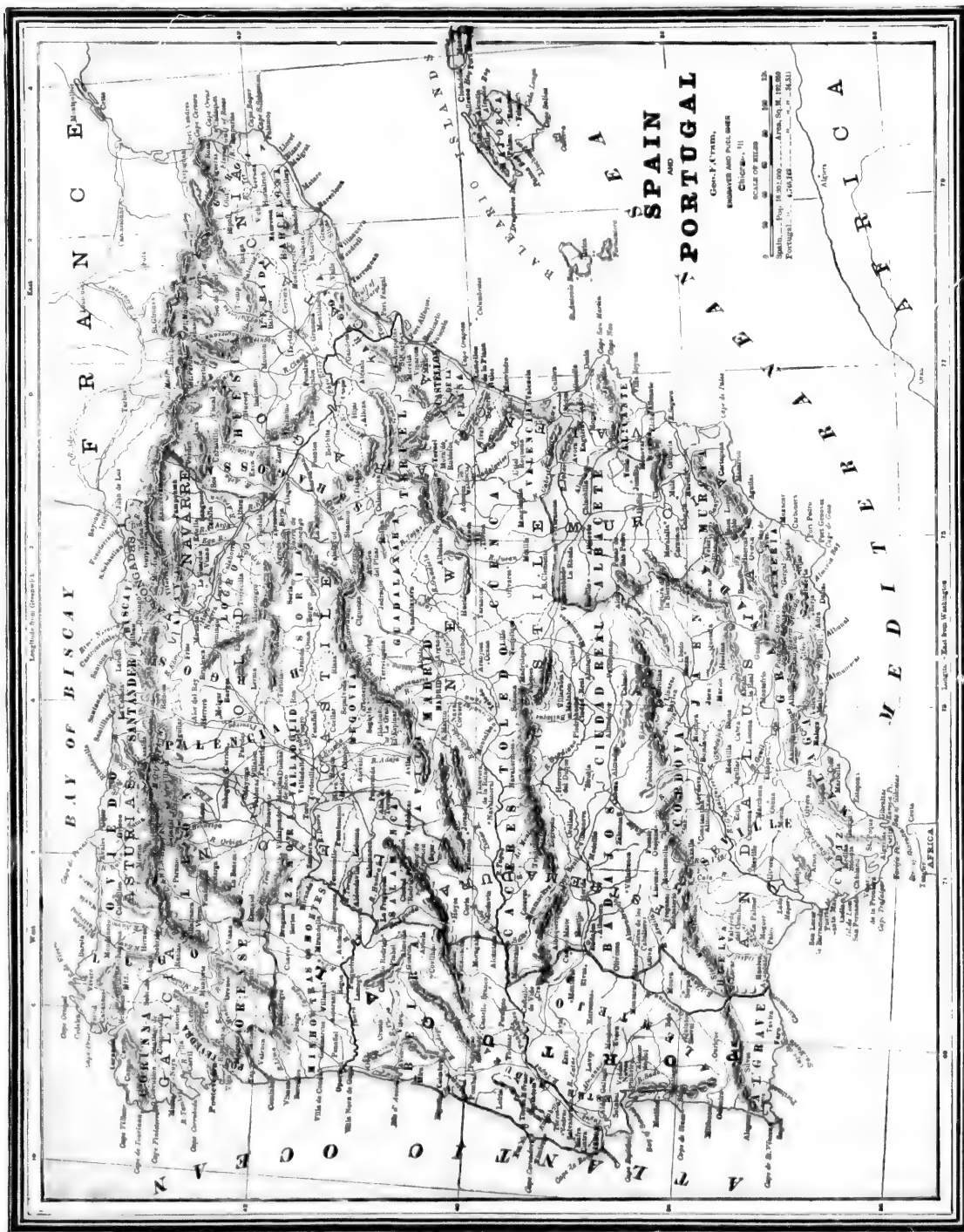


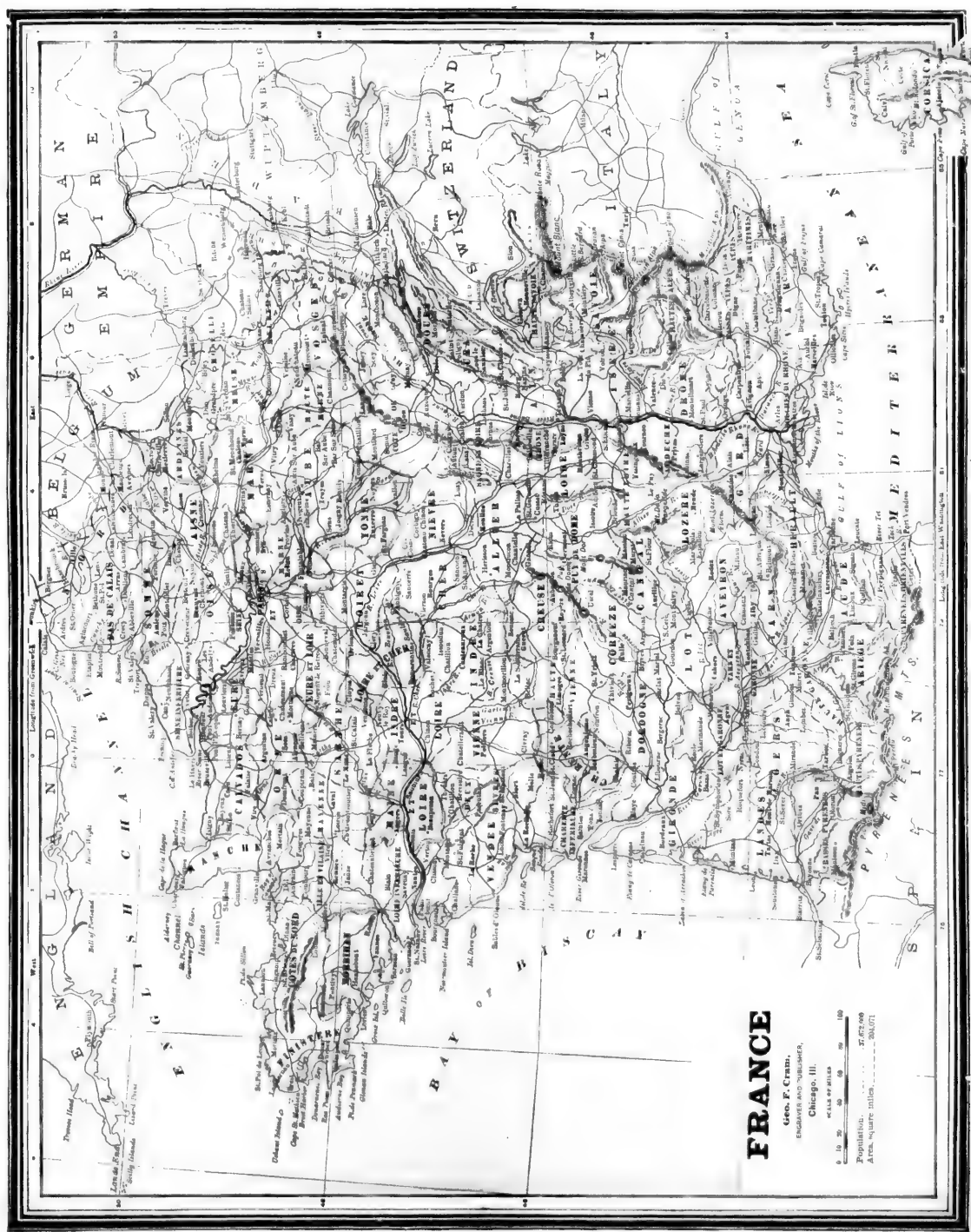


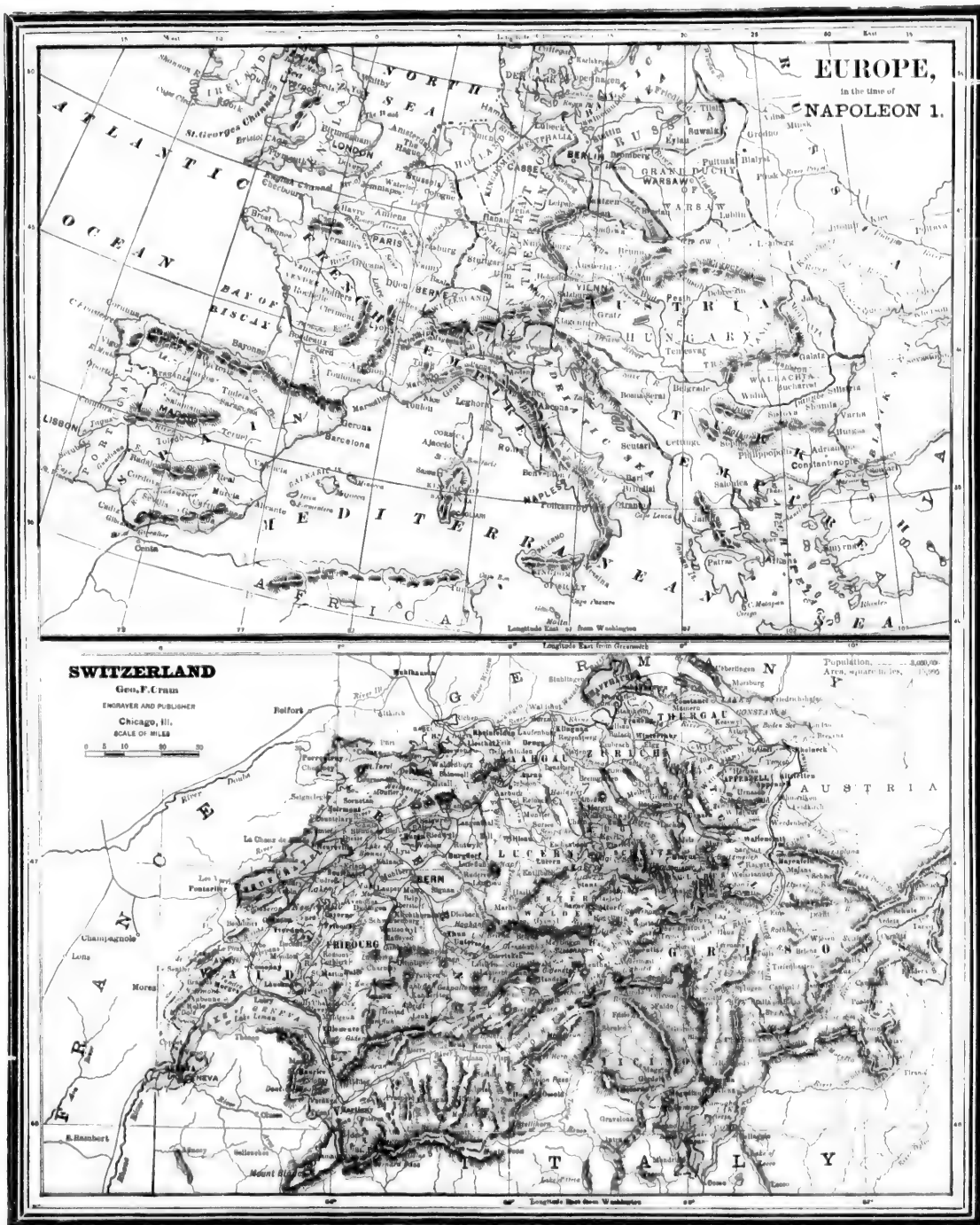


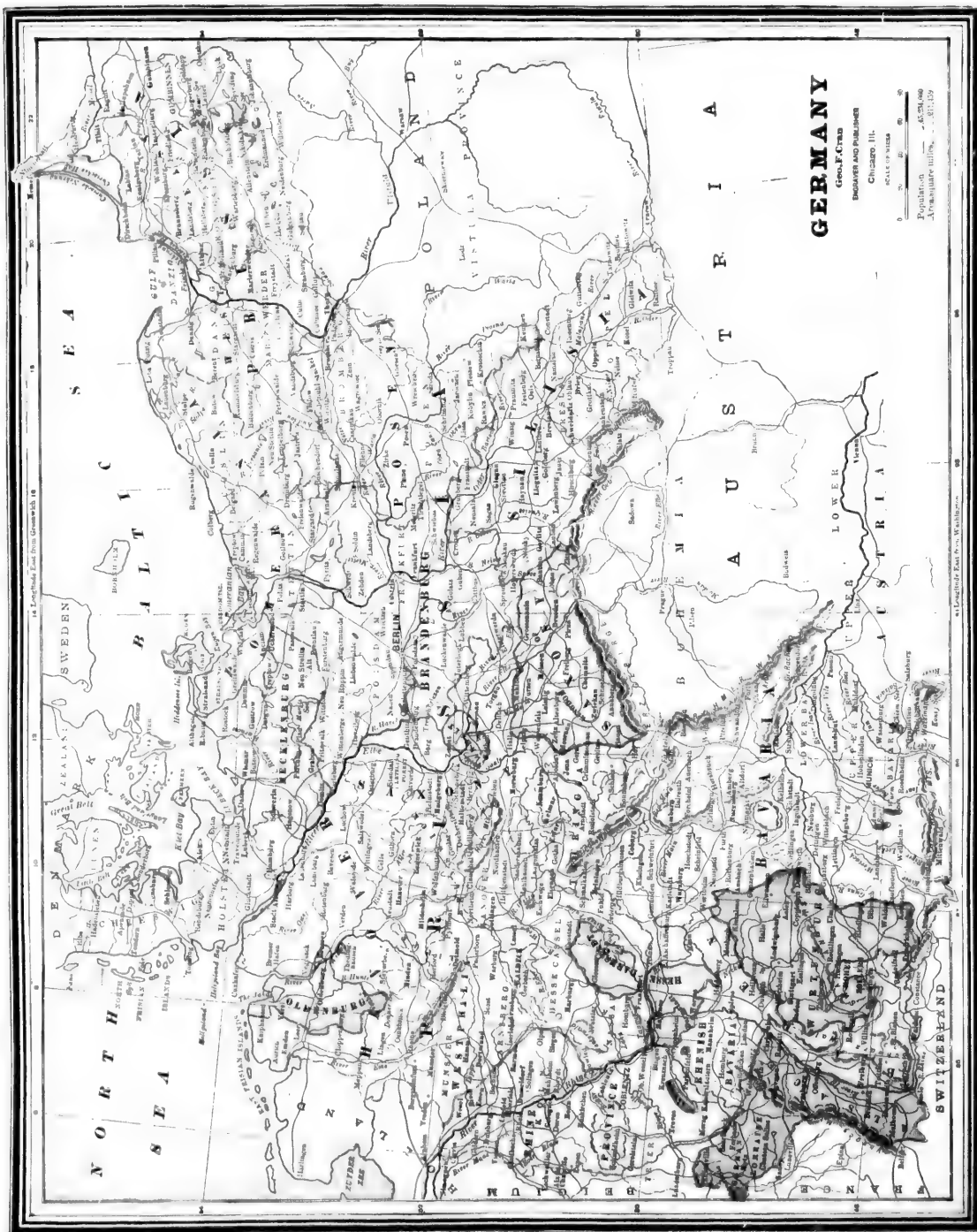


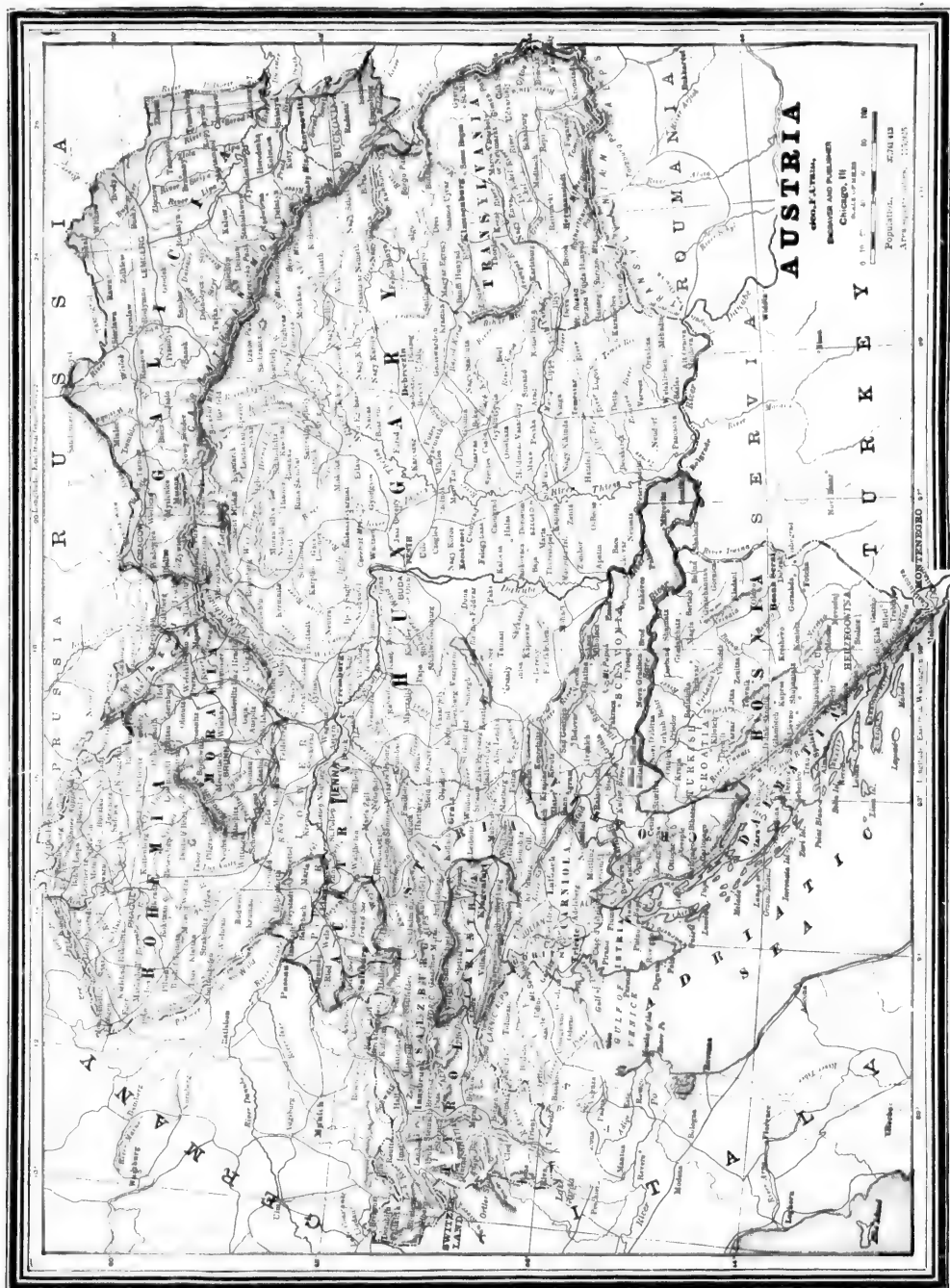




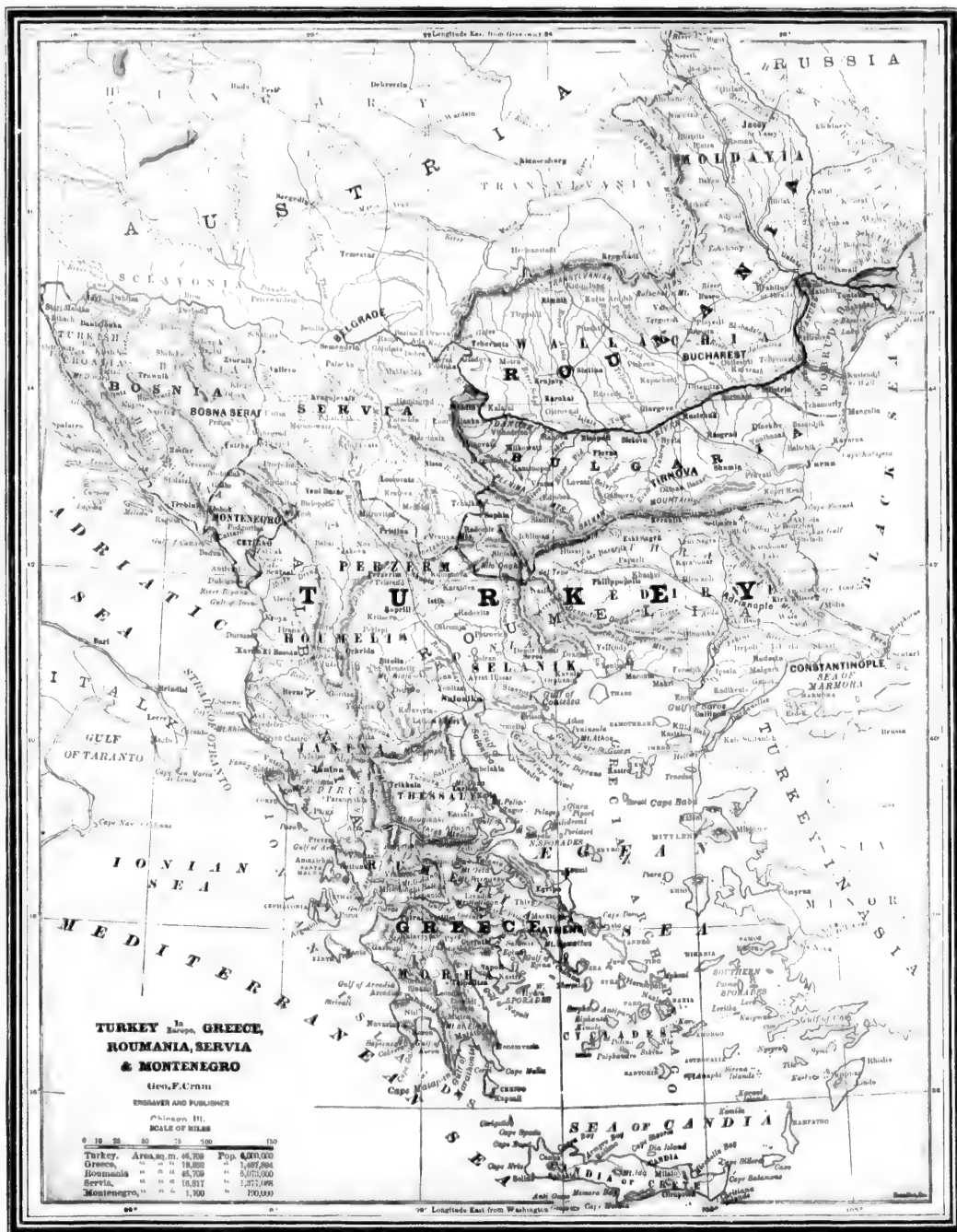












RUSSIA

Geo. F. Crain,
ENGRAVER AND PUBLISHER,
Chicago, Ill.

Scale of Miles 0 50 100 150 200 250
Population 94,542,100
Area, square miles, 6,102,136

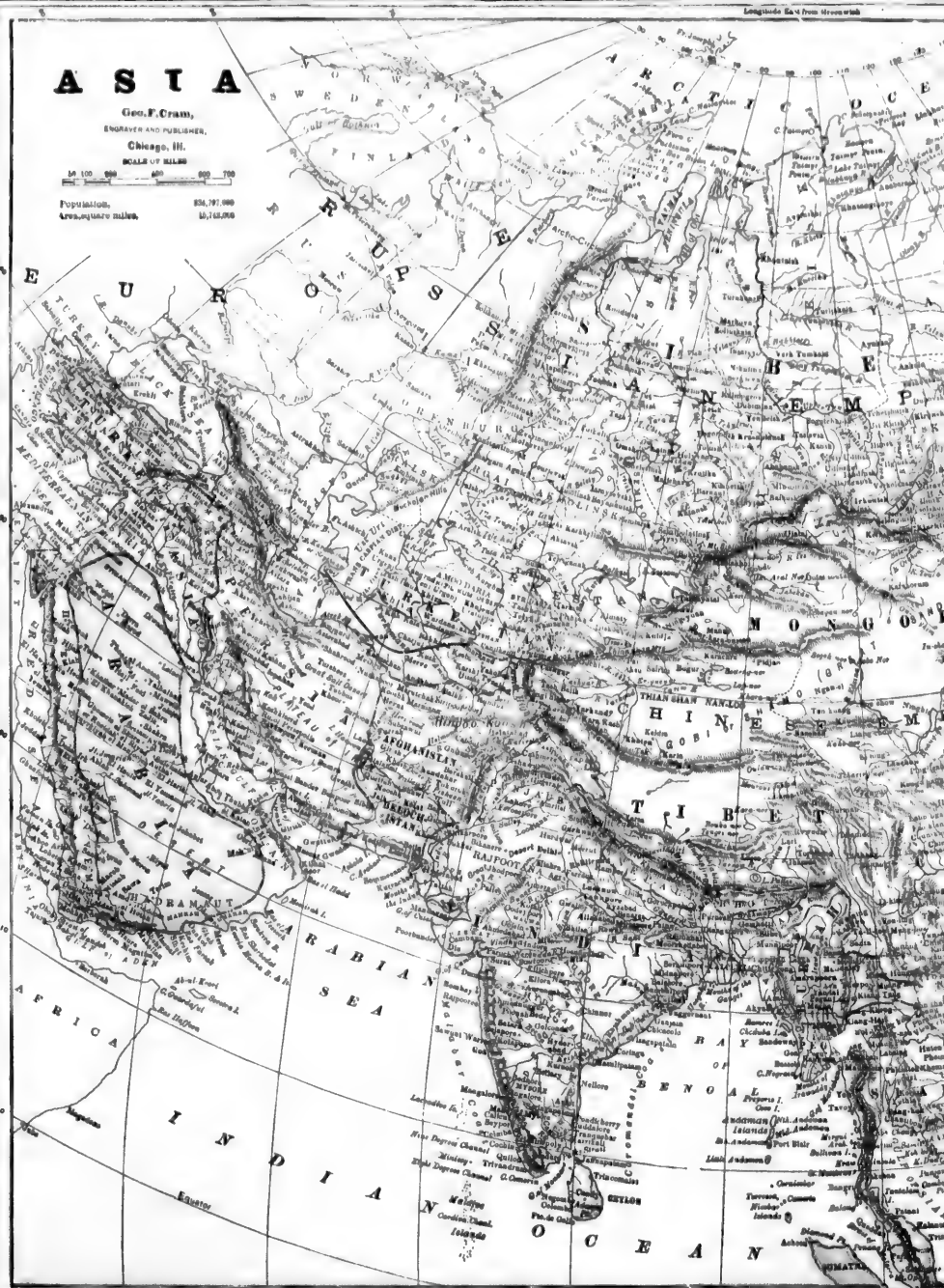


ASIA

Gen. F. Cram,
ENGRAVER AND PUBLISHER,
Chicago, Ill.

SCALE OF MILES
0 100 200 300 400 500 600 700

Population, 856,797,000
Area, square miles, 17,132,000





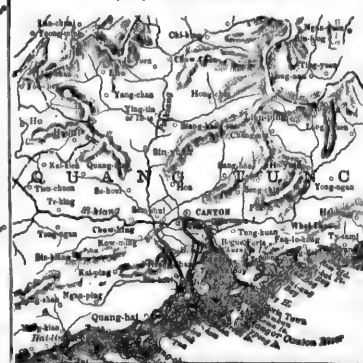
JERUSALEM.

Lat. 32° 10' N. Long. 34° 45' E.
or nearly on the same line of Lat. as Way Cross Sea.



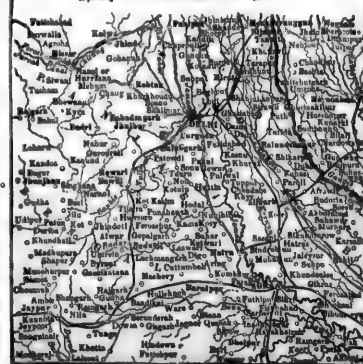
CANTON.

Lat. 23° 15' N. Long. 113° 30' E.
or nearly on the same line of Lat. as Havana, Cuba.



DELHI.

Lat. 28° 45' N. Long. 77° 15' E.
or nearly on the same line of Lat. as India's Sea.



TURKISH EMPIRE
IN
EUROPE AND ASIA,
GREECE ROMANILECT.

Area in
English Sq. Miles
Population
Turkey in Europe 27,500
" in Asia 421,000
United Kingdom 26,140,000

Territory ceded by Turkey under Treaty 1878
Population
Turkey in Europe 421,000
" in Asia 800,000

Scale of Miles
0 20 40 60 80 100

The map shows the extensive territory of the Ottoman Empire, including the Balkans, the Middle East, and North Africa. Major cities like Constantinople, Bagdad, and Cairo are marked. The map is oriented with North at the top, and the Mediterranean Sea is visible to the west and south.

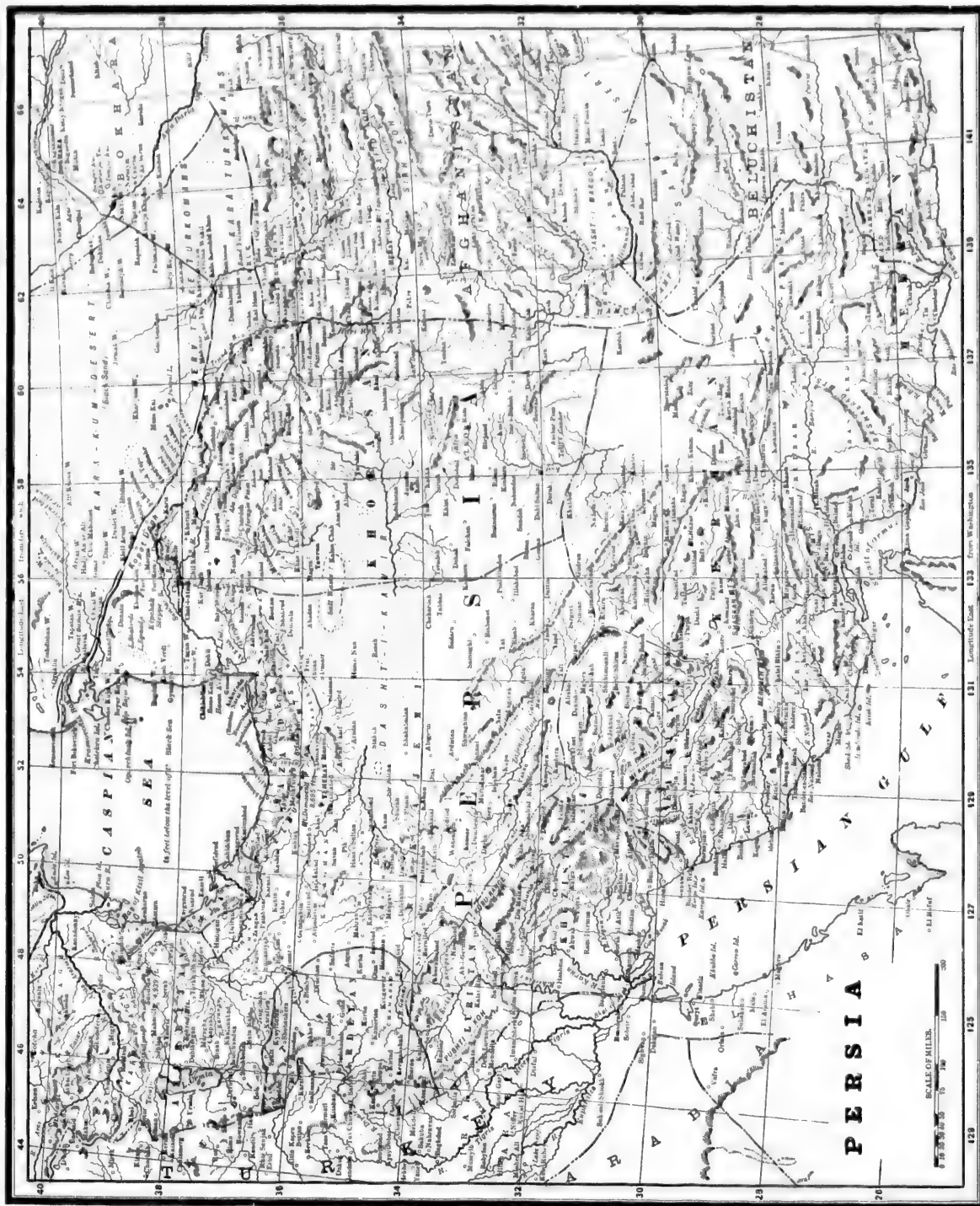
Turkey in Europe	62,115	4,730,000
" in Asia	730,359	13,511,000
United Kingdom	141,115	34,191,000

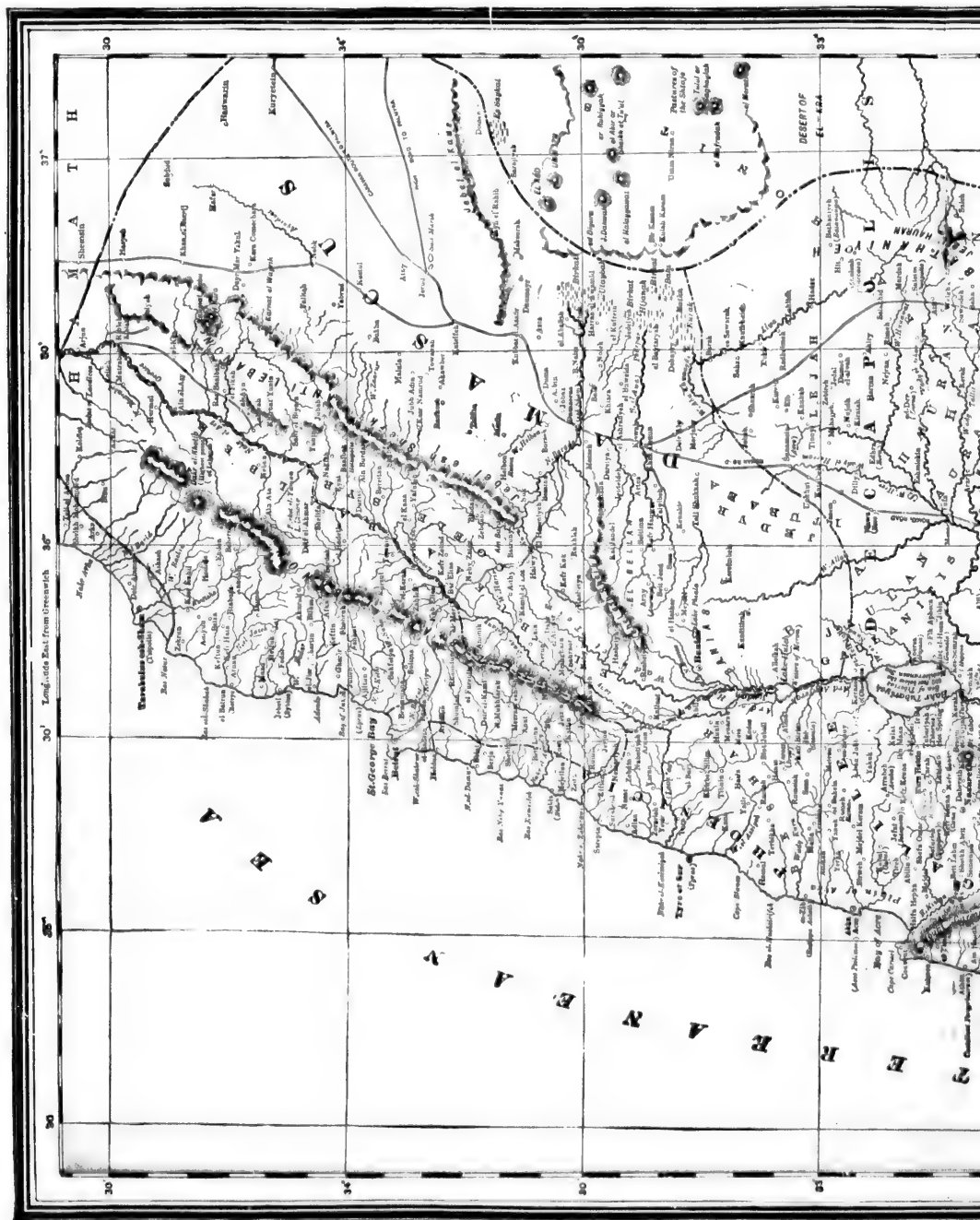
Territory ceded by Turkey under Treaty 1879

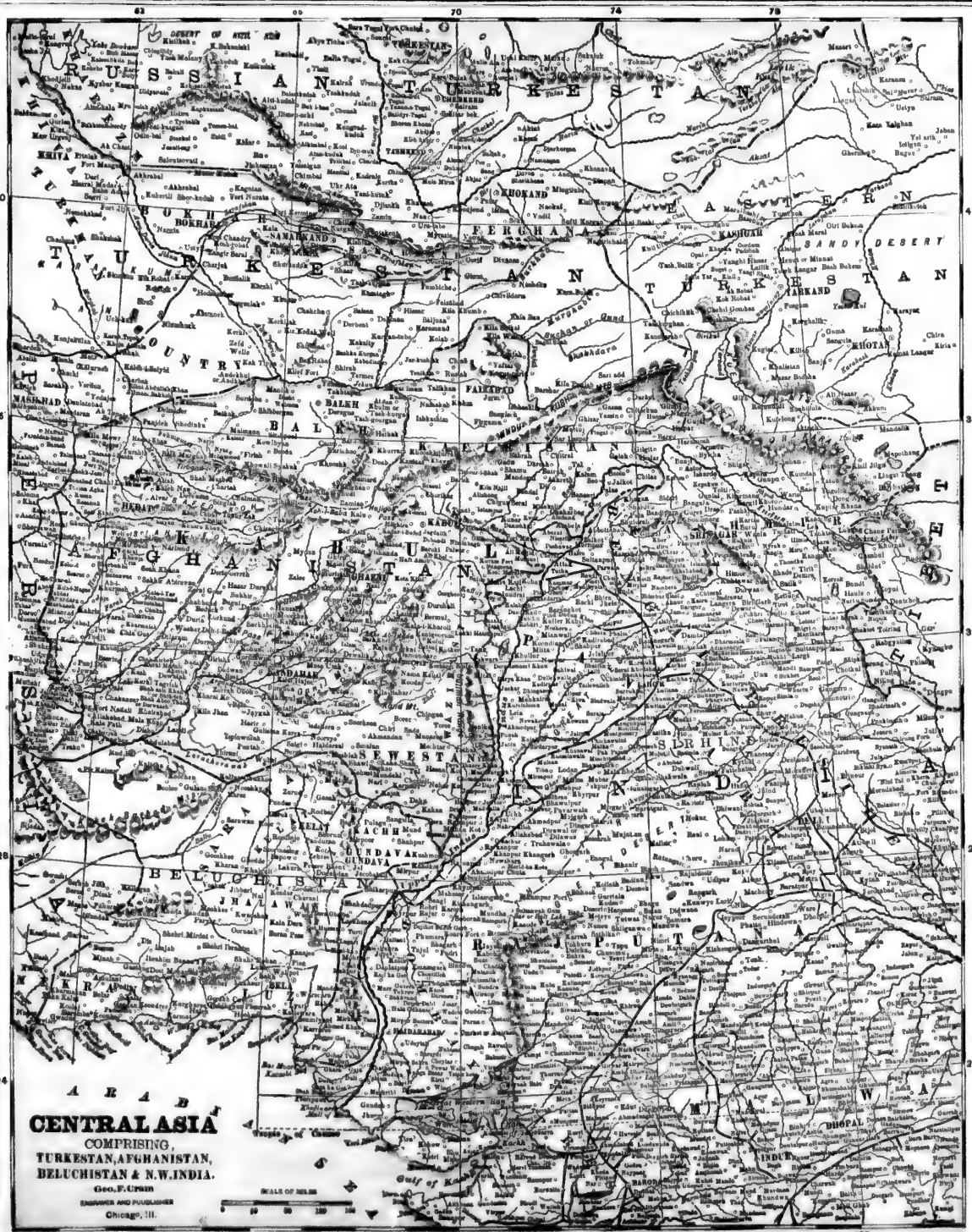
Territory ceded by Turkey under Treaty 1879	Area in English Sq. Miles	Population
Turkey in Europe	41,26	2,311,000
in Asia	1,770	20,644

8	Turkey in Europe	Area in English Sq. Miles	Population
	61,26	4,311,100
	in Asia	8,670	30,644

531:W 407:V28







CENTRAL ASIA

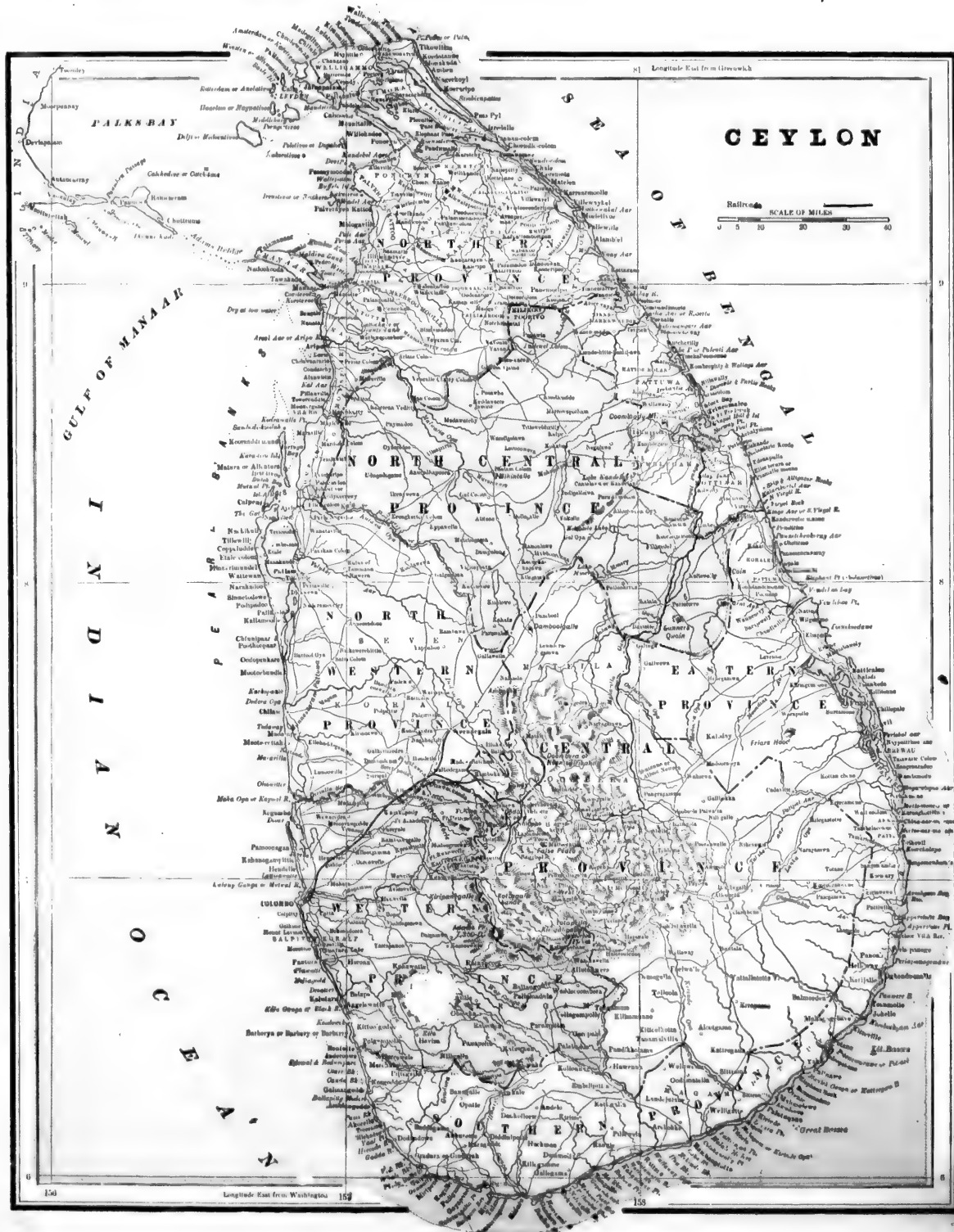
COMPRISING,
TURKISTAN, AFGHANISTAN,
BELUCHISTAN & N.W. INDIA.

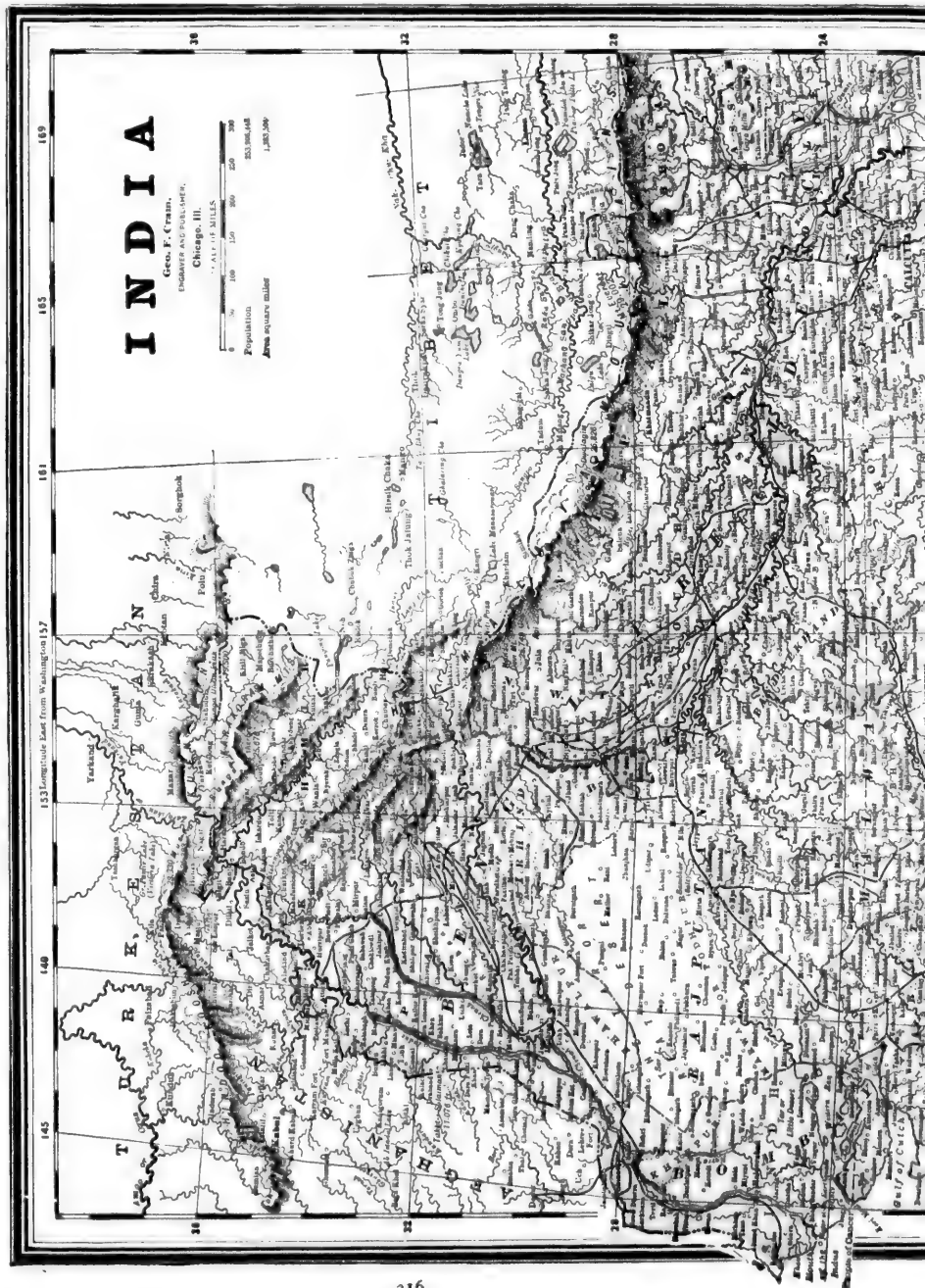
Geo. F. Cram

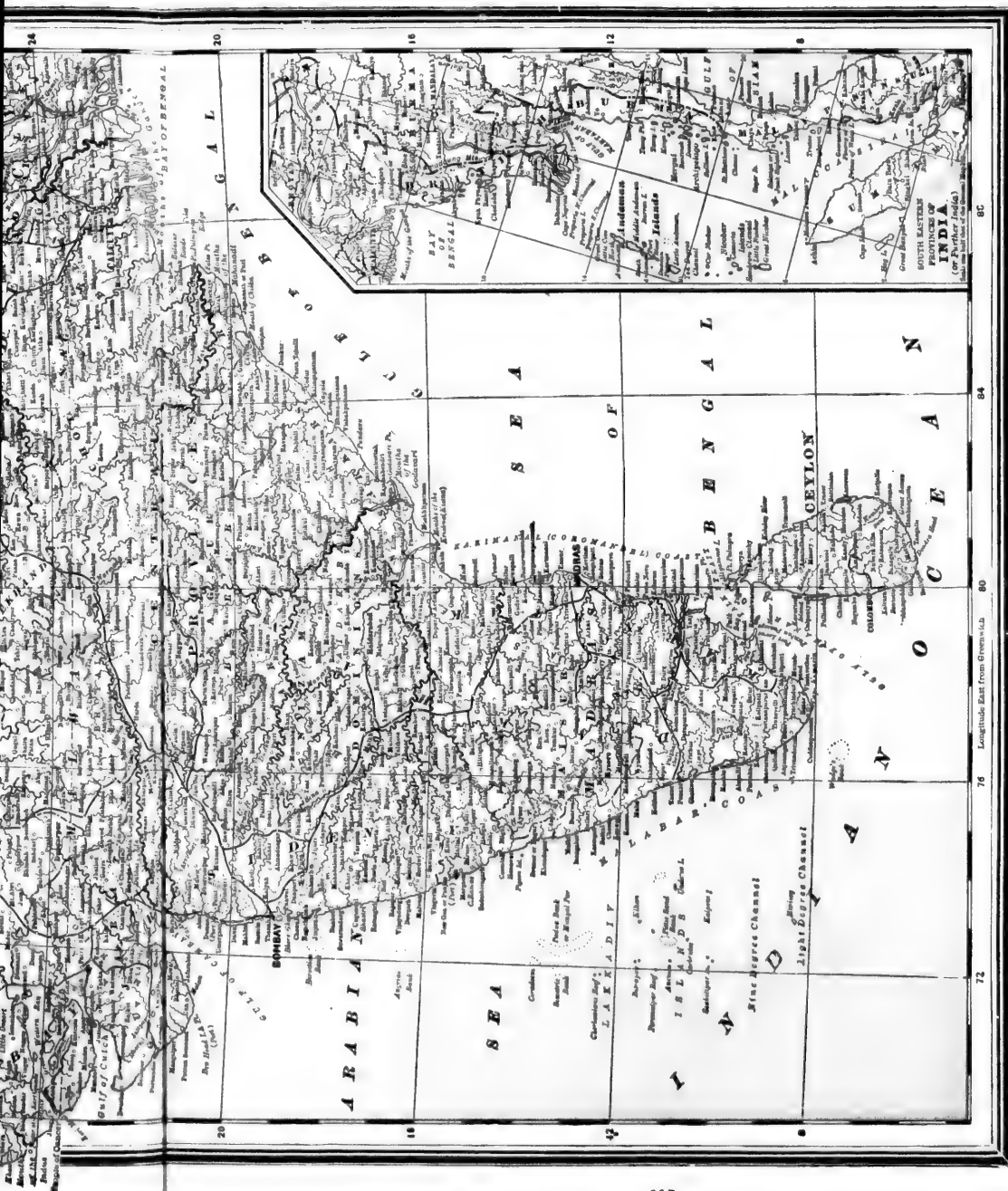
ENGRAYER AND PUBLISHER

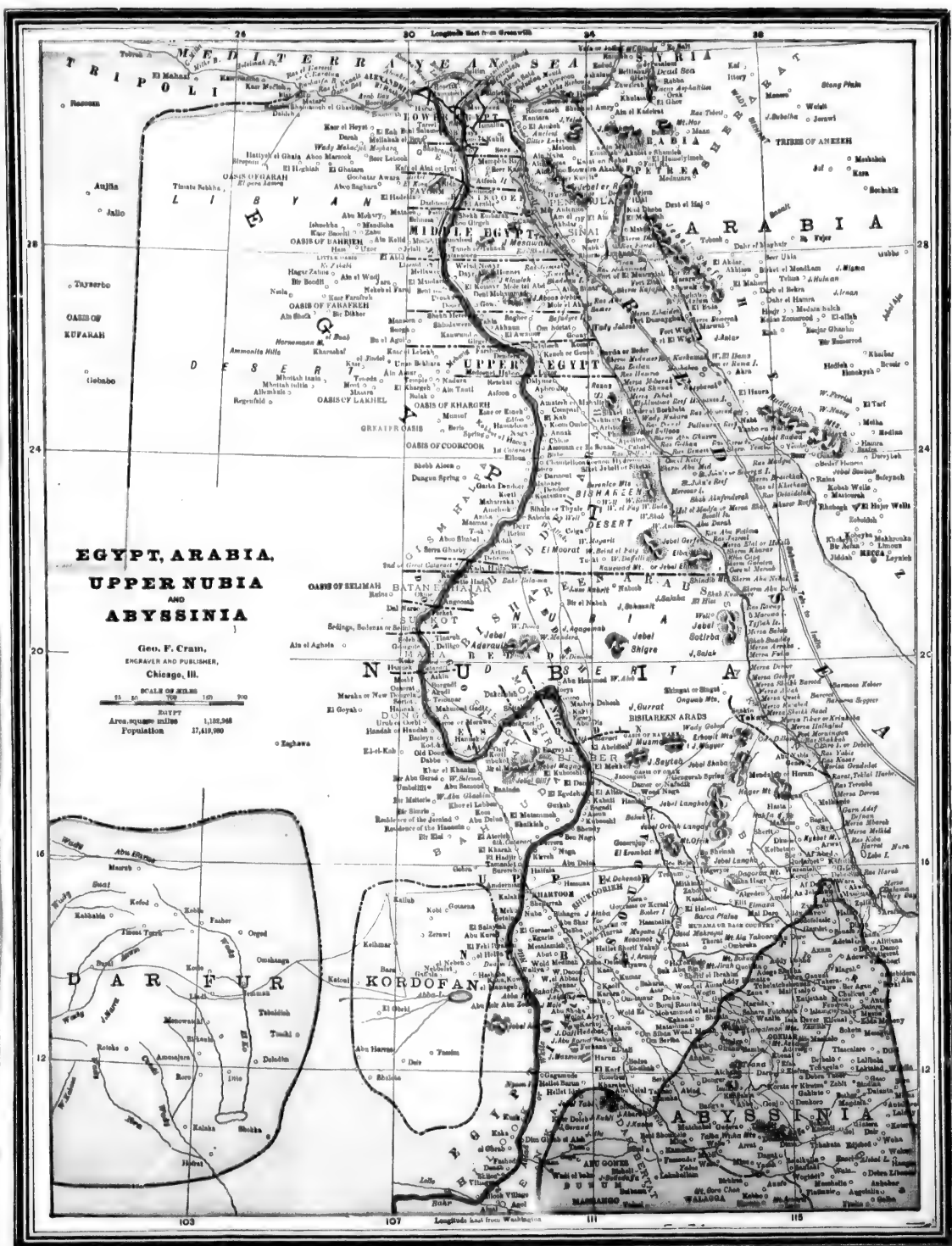
Chicago, Ill.

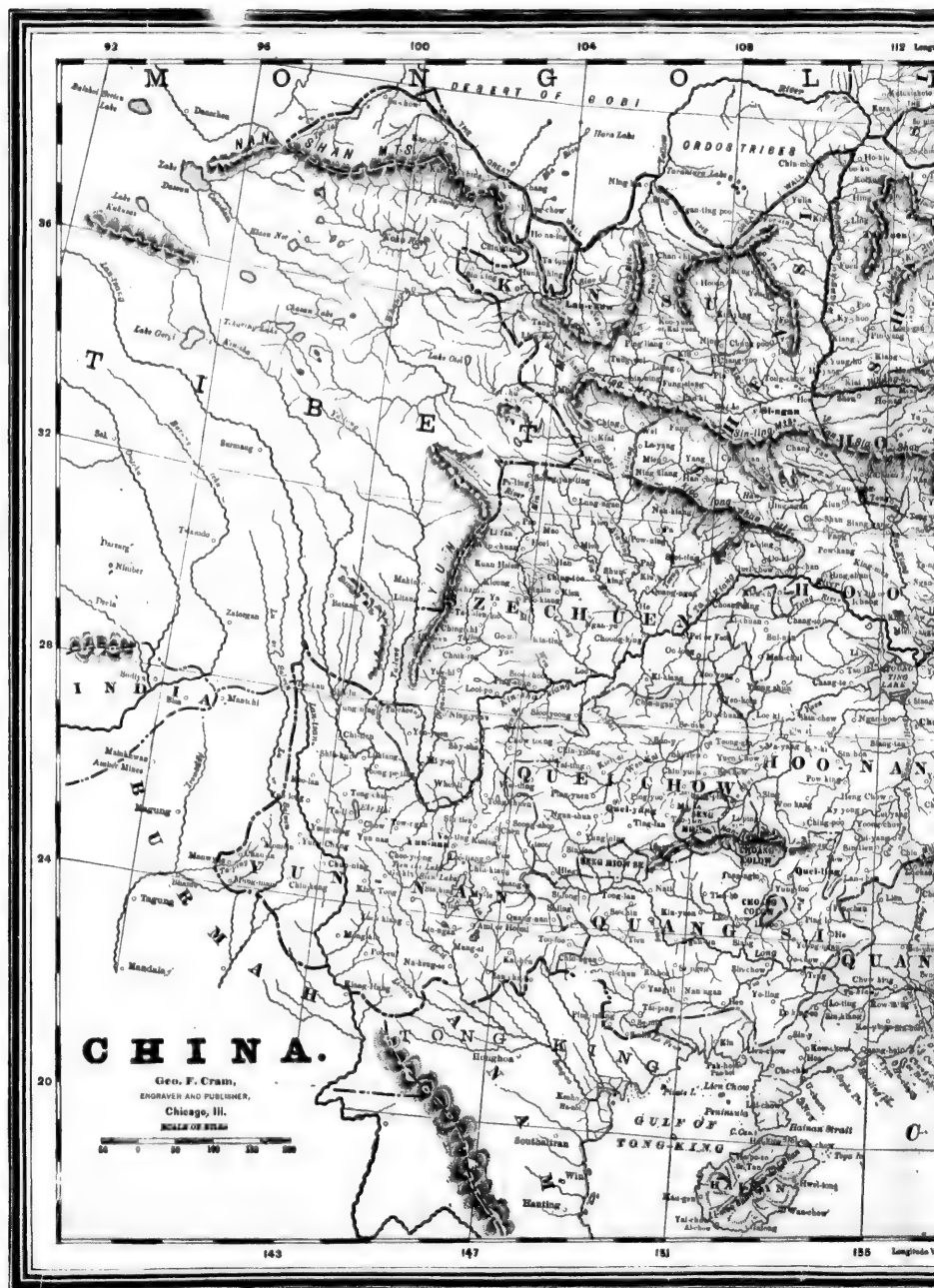
SCALE OF MILES
0 100 200











AUSTRALIA & TASMANIA

Includes New Guinea,
Chile, & Oceania.

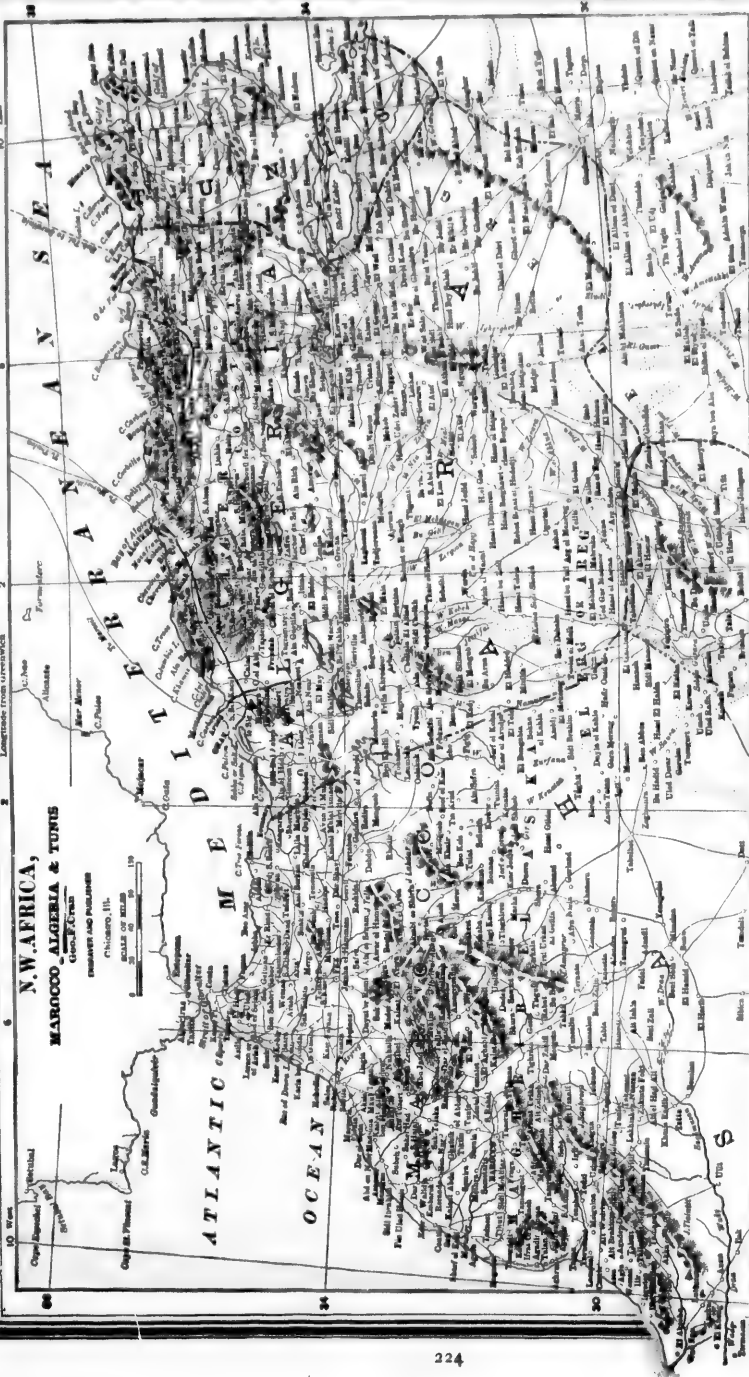
Area	9,448,000
Population	1,200,000
Area	29,000
Population	100,000



N.W. AFRICA, MOROCCO, ALGERIA & TUNIS

Geog. F. Cram,
ENGINEER AND PUBLISHER,
CHICAGO, ILL.

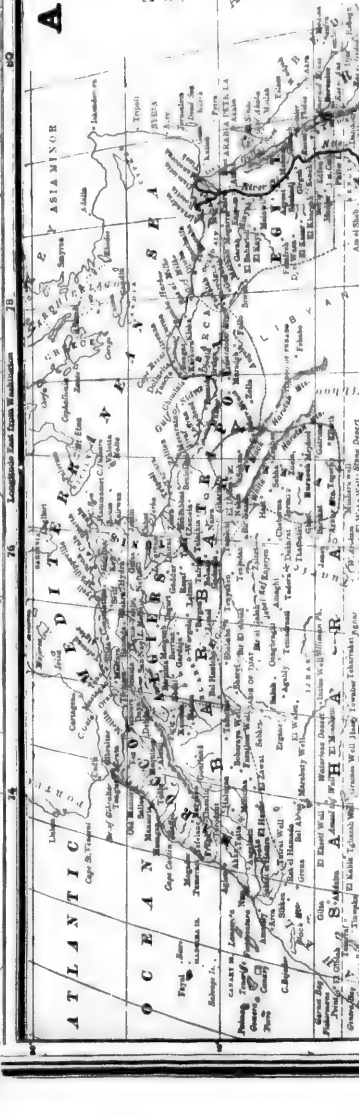
SCALE OF MILES
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250 260 270 280 290 300 310 320 330 340 350 360 370 380 390 400 410 420 430 440 450 460 470 480 490 500 510 520 530 540 550 560 570 580 590 600 610 620 630 640 650 660 670 680 690 700 710 720 730 740 750 760 770 780 790 800 810 820 830 840 850 860 870 880 890 900 910 920 930 940 950 960 970 980 990 1000

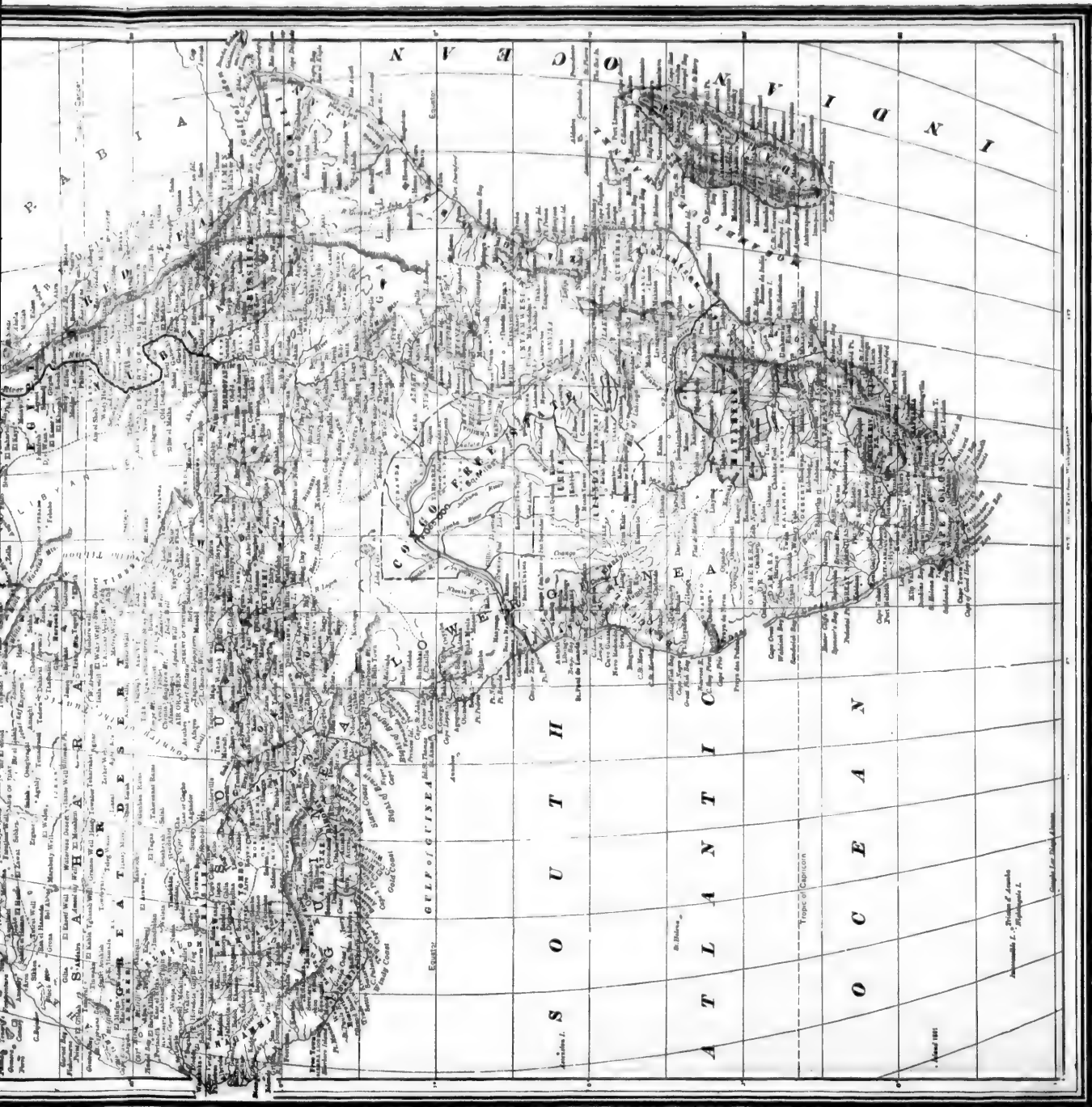


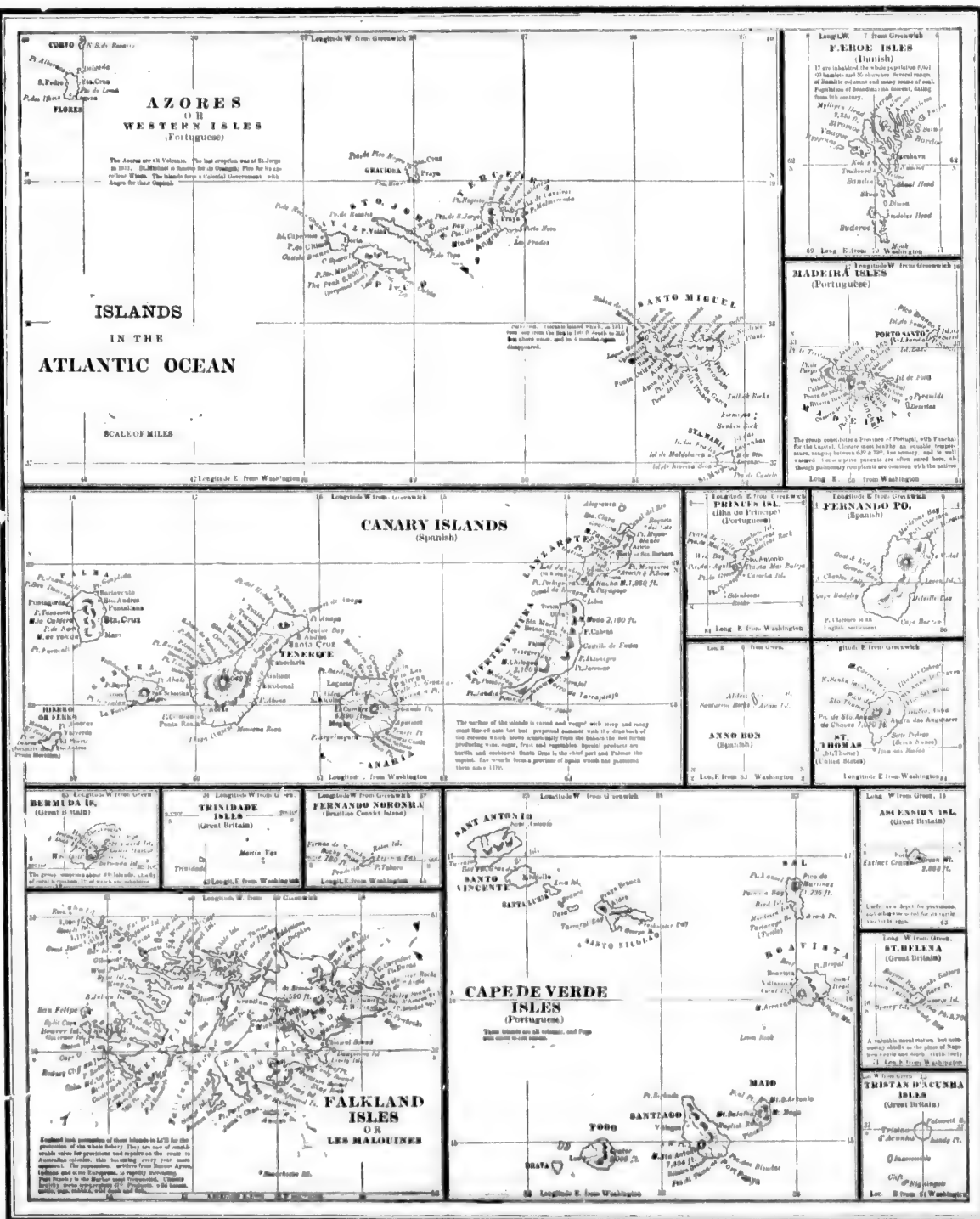
AFRICA

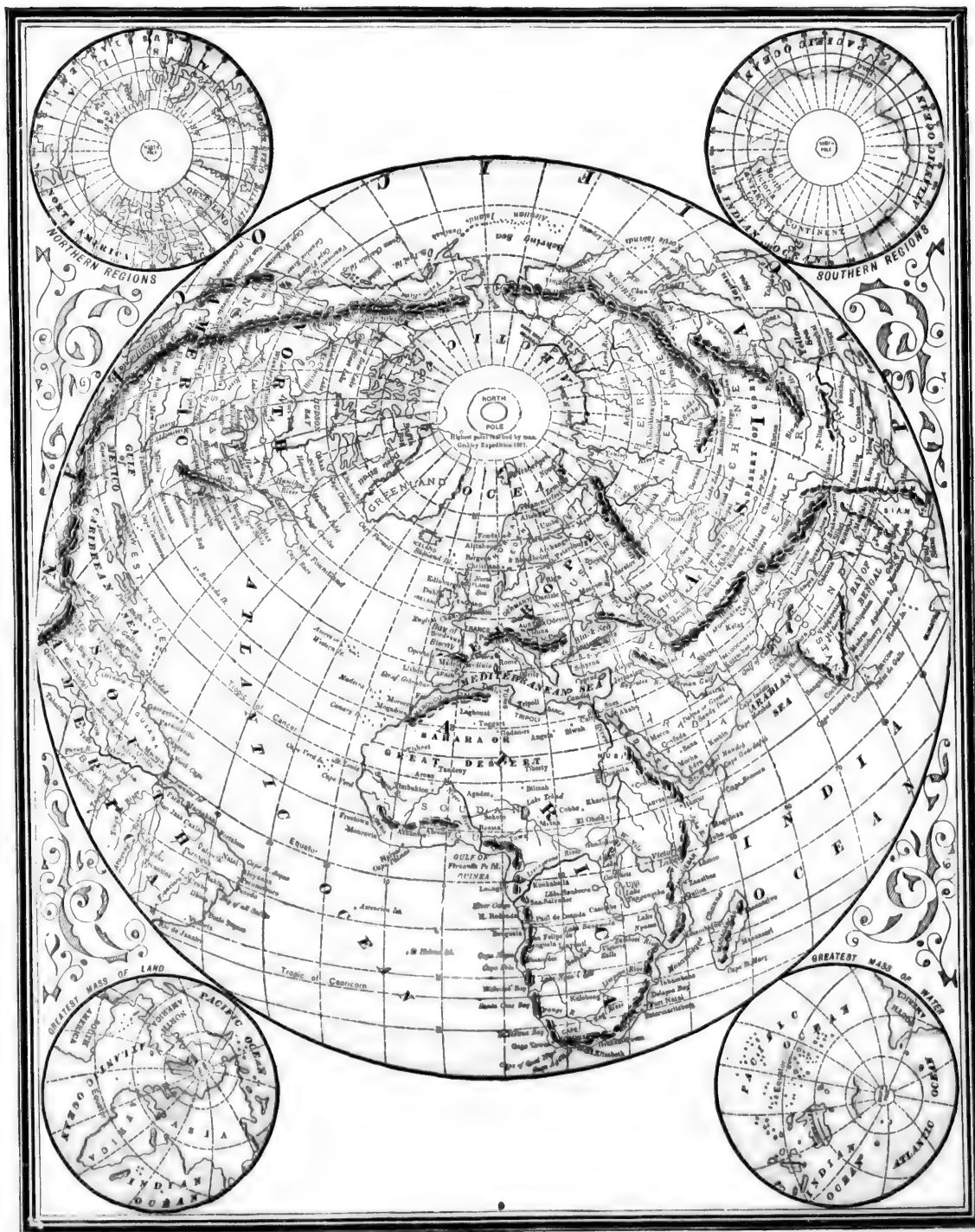
Geog. F. Cram,
ENGINEER AND PUBLISHER,
CHICAGO, ILL.

SCALE OF MILES
0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500 1600 1700 1800 1900 2000 2100 2200 2300 2400 2500 2600 2700 2800 2900 3000 3100 3200 3300 3400 3500 3600 3700 3800 3900 4000 4100 4200 4300 4400 4500 4600 4700 4800 4900 5000 5100 5200 5300 5400 5500 5600 5700 5800 5900 6000 6100 6200 6300 6400 6500 6600 6700 6800 6900 7000 7100 7200 7300 7400 7500 7600 7700 7800 7900 8000 8100 8200 8300 8400 8500 8600 8700 8800 8900 9000 9100 9200 9300 9400 9500 9600 9700 9800 9900 10000

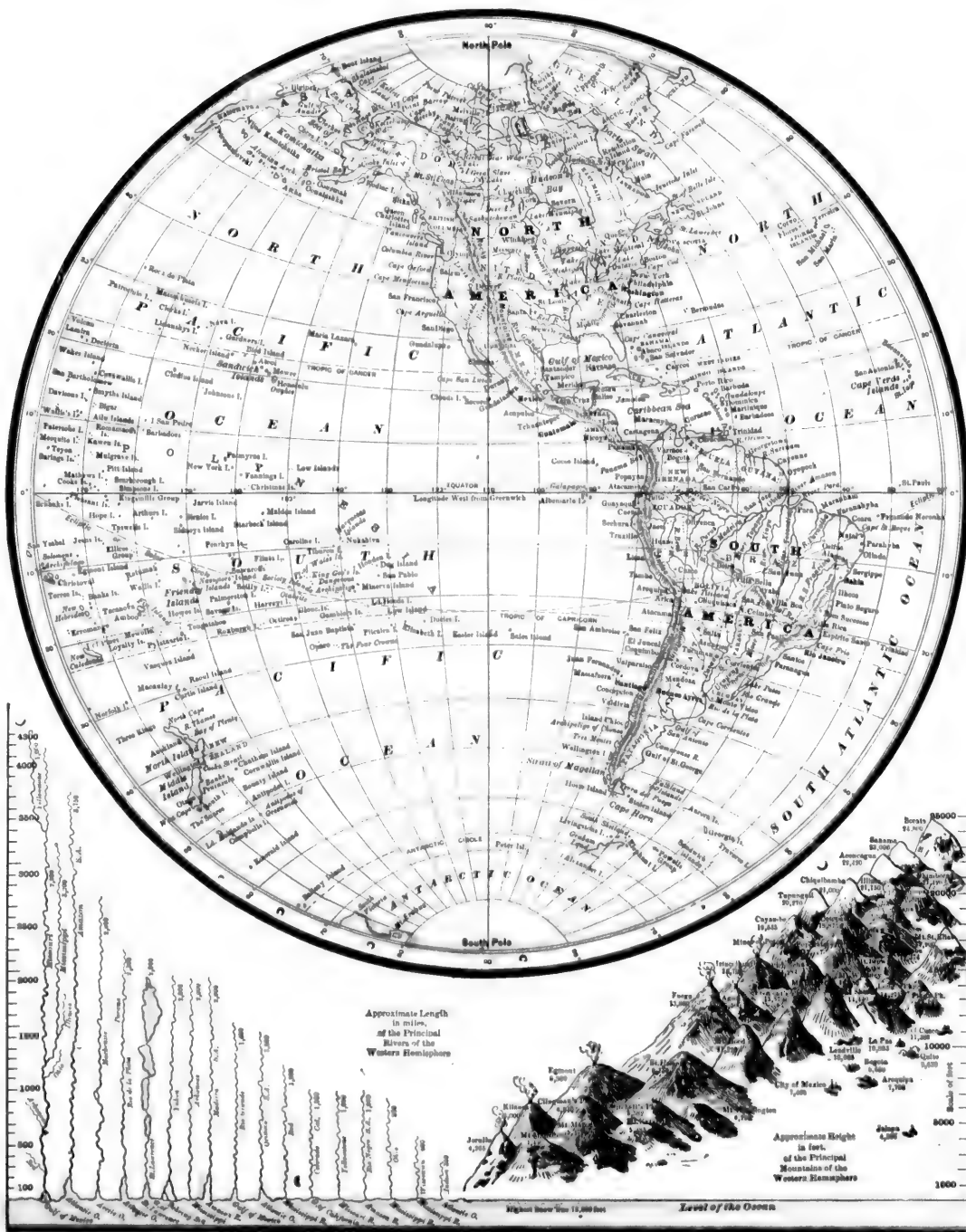




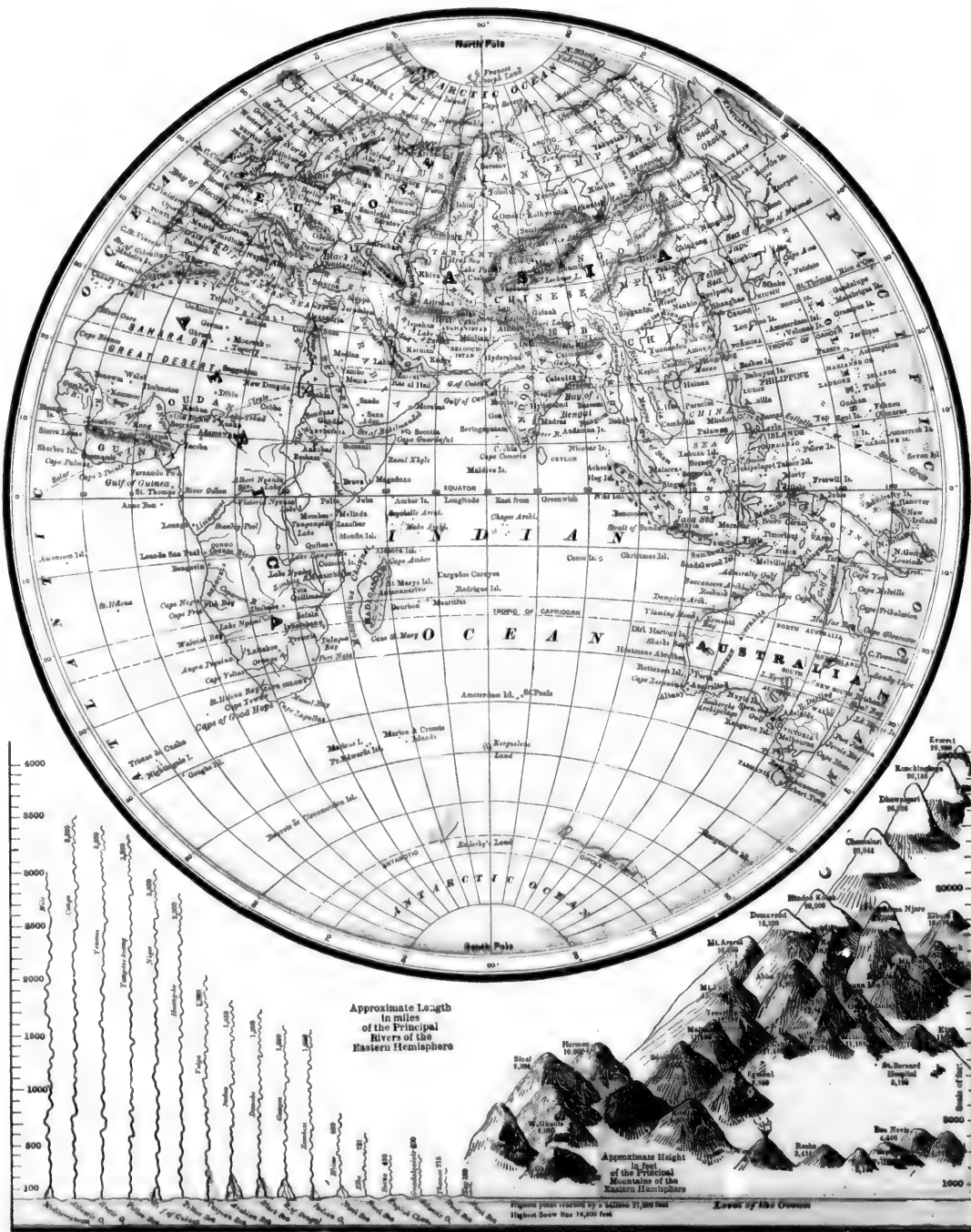


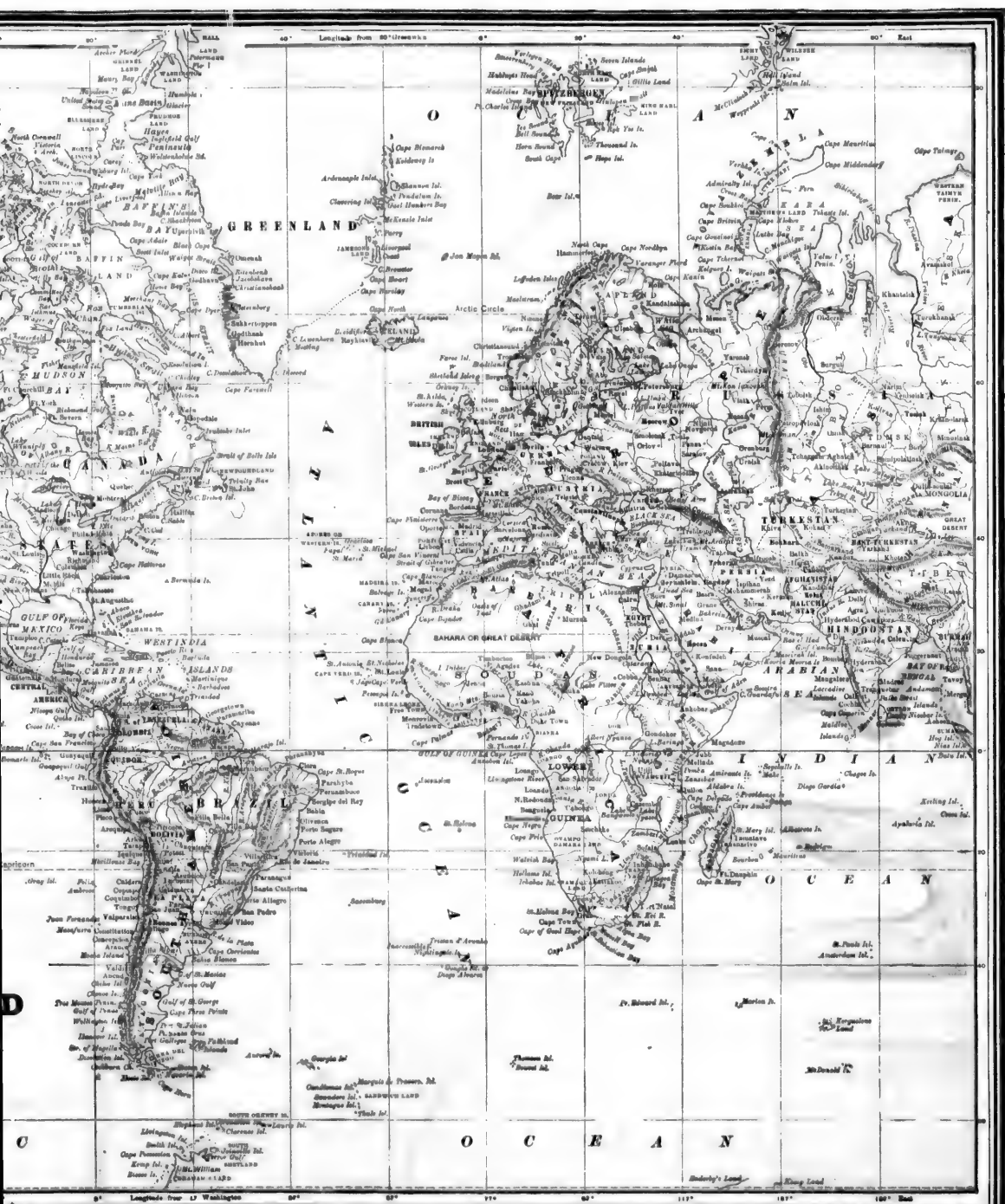


WESTERN HEMISPHERE



EASTERN HEMISPHERE





ASTRONOMICAL CHART

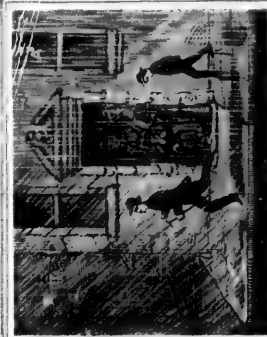


FIG. 4.
Apparent direction of the Shower
as a person viewing visually

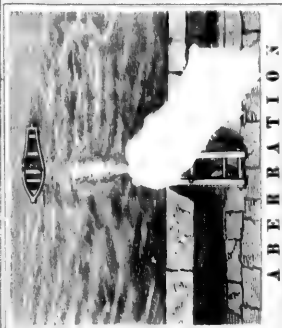
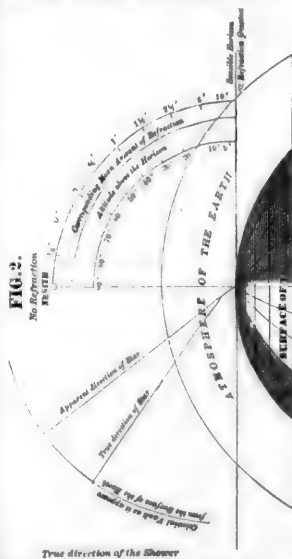


FIG. 5.

REFRACTION

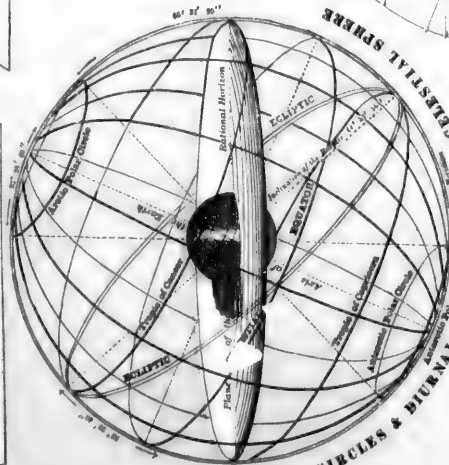


FIG. 1.

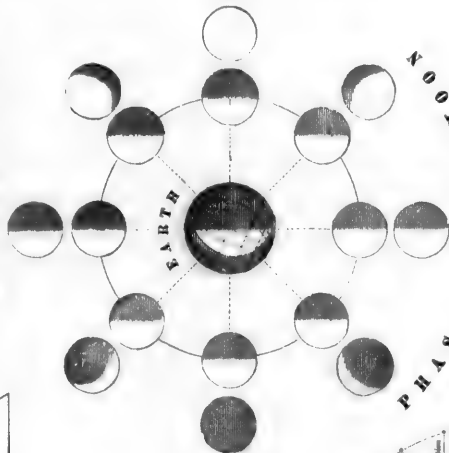


FIG. 6.

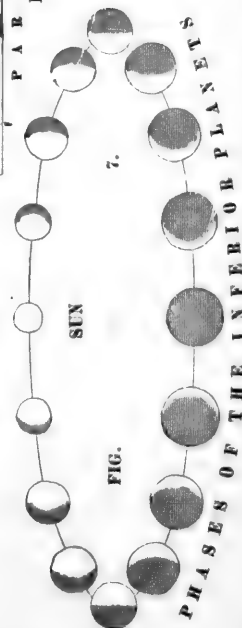
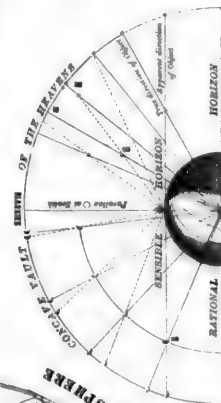


FIG. 7.

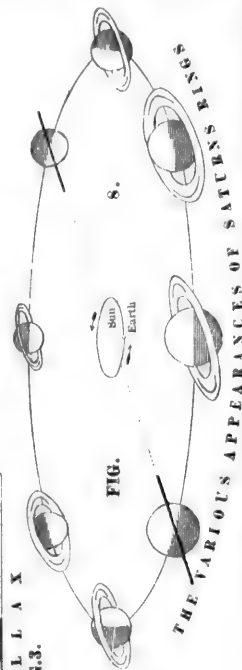


FIG. 8.

COMPARATIVE SIZE OF THE PLANETS.

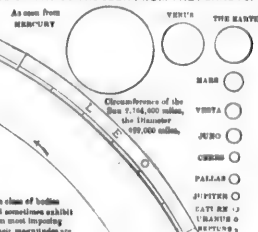


The Planets are situated in their Orbits by the opposing actions of the centrifugal and the centripetal forces. Earth Plane, has a motion 9 times the size of the Sun.

The diameter of the SUN is equal to 111 1/2 times that of the Earth. The circumference embraces a volume of matter about 1,300,000 times larger than our globe and more than 300 times greater than that of all the Planets. The Sun's mean distance is equal to 17,000 times the diameter of the Earth, or about 94,000,000 miles.

THE SOLAR SYSTEM

COMPARATIVE SIZE OF THE SUN AS SEEN FROM THE PLANETS.



Comets form the most numerous class of bodies which belong to our System and sometimes exhibit appearances which render them most imposing of all celestial phenomena. Their magnitudes are extremely variable and there is a greater variety than is observed with respect to their motions; some of them moving in the same direction as the Planets some in an opposite direction, and others at right angles to the orbit of the Planets. Notwithstanding the great number of Comets, few are certainly known to have been observed to recur in revolutions. Halley's returns in 76 years, Encke's in 5 years, Biela's in 6 years, 9 months and 14 days in 7 1/2 years.

Four small planets, Ceres, Pallas, Juno and Vesta, first discovered near the beginning of the present century, and afterwards of a hundred others discovered since 1801, are known as Minor Planets, or Asteroids. Their dimensions are much less than those of the other planets, the largest not being 20 miles in diameter, while many are less than 10 miles. Their orbits are much more elliptical than those of the other planets, and so many points cross each other. They occupy a belt of more than 700,000,000 miles width, between the orbits of Mars and Jupiter, their mean distances from the Sun ranging from about 200 to 300 millions of miles.

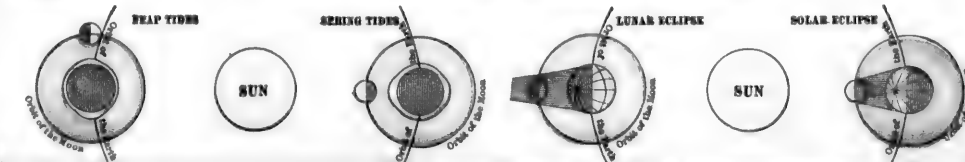
The Solar System consists of the Sun, from which it takes its name, the Planets, and an indefinite number of Comets. Of the Planets, such as move directly round the Sun are called Primary, others are called Secondary, because they move around the primary Planets. The secondary Planets are denominated Satellites. The Earth has 1 Satellite or Moon, Jupiter 4, Saturn 6, Uranus, probably 6, Neptune at least 1. Saturn is surrounded by a circular belt.

The mean orbital velocity of the Planets is as follows: Mercury 10.7 miles per second, Venus 10.7, Earth 10.7, Mars 10.7, Jupiter 10.7, Saturn 10.7, Uranus 10.7, Neptune 10.7.

On account of their great distance, the orbits of Saturn, Uranus & Neptune cannot be shown on this diagram. (See below.)

	Diameter in miles	Length of year	Length of day	Mean motion
MERCURY	3,100	88 days	58 hours 15 min.	108,000 miles
VENUS	7,710	224 1/2 "	58 1/2 "	68,000 "
EARTH	7,910	365 1/4 "	24 "	68,000 "
MARS	4,000	687 "	24 1/2 "	52,000 "
JUPITER	86,880	12 years nearly	9 1/2 "	31,000 "
SATURN	79,810	29 1/2 "	10 1/2 "	31,000 "
URANUS	34,950	84 "	10 1/2 "	20,000 "
NEPTUNE	47,000	166 "	16 1/2 "	19,000 "

COMPARATIVE DISTANCES OF THE PLANETS FROM THE SUN.



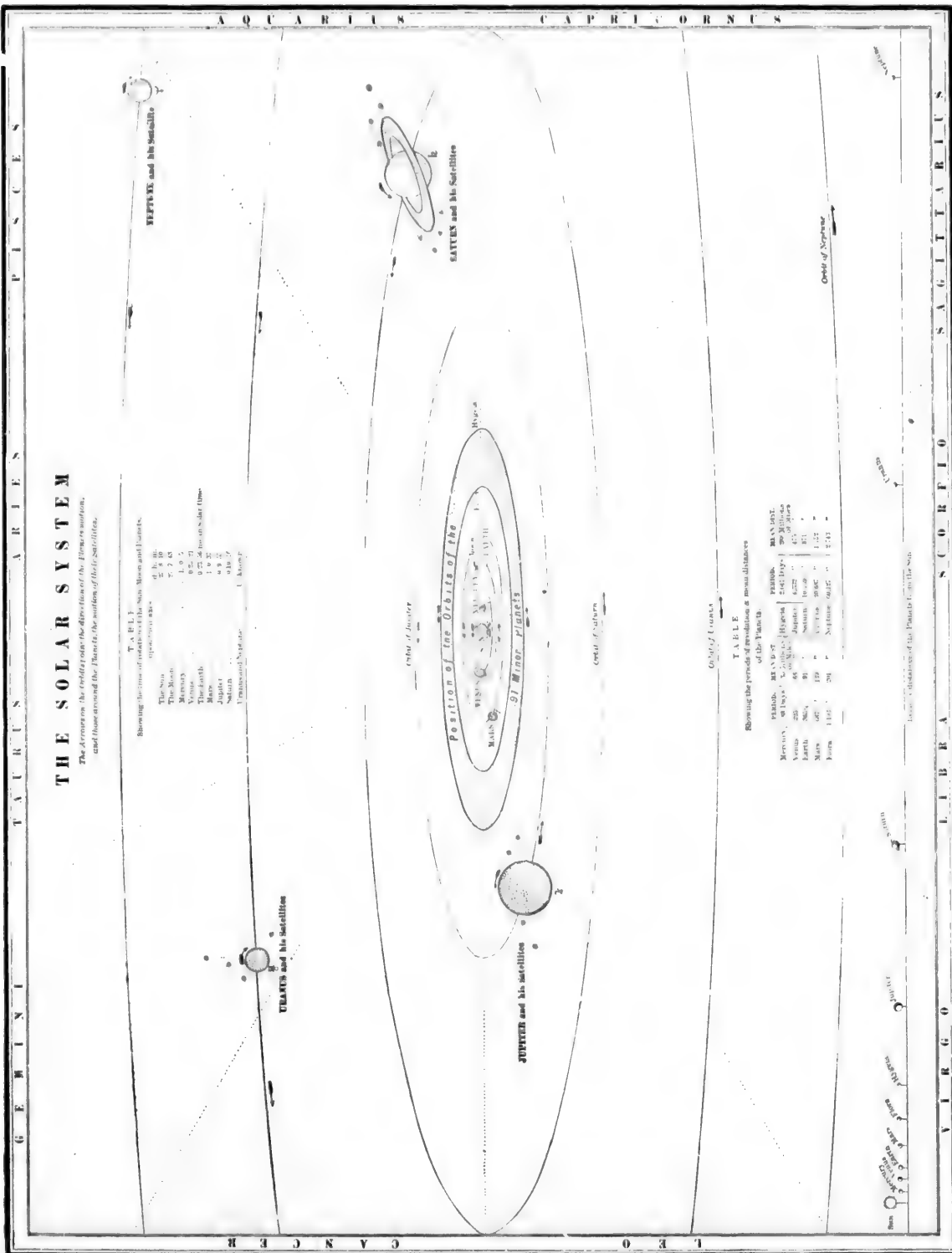


TABLE I
Showing the time of revolution of the planets and their satellites.

Planet	Time of revolution in days
The Sun	25 54 30
Mercury	87 96
Venus	224 65
Earth	365 25 6
Mars	686 97 22
Jupiter	4332 57
Saturn	9 454 2
Uranus	30 688 10
Neptune	60 188 10

TABLE II
Showing the periods of revolution of the moons of the planets.

Planet	Moons	Period of revolution in days
Mercury	None	-
Venus	None	-
Earth	1	29 12 44
Mars	2	686 97 22
Jupiter	4	9 454 2
Saturn	9	9 454 2
Uranus	5	30 688 10
Neptune	1	60 188 10

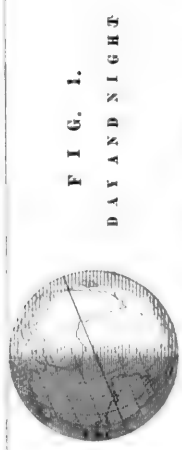


FIG. 1.
DAY AND NIGHT

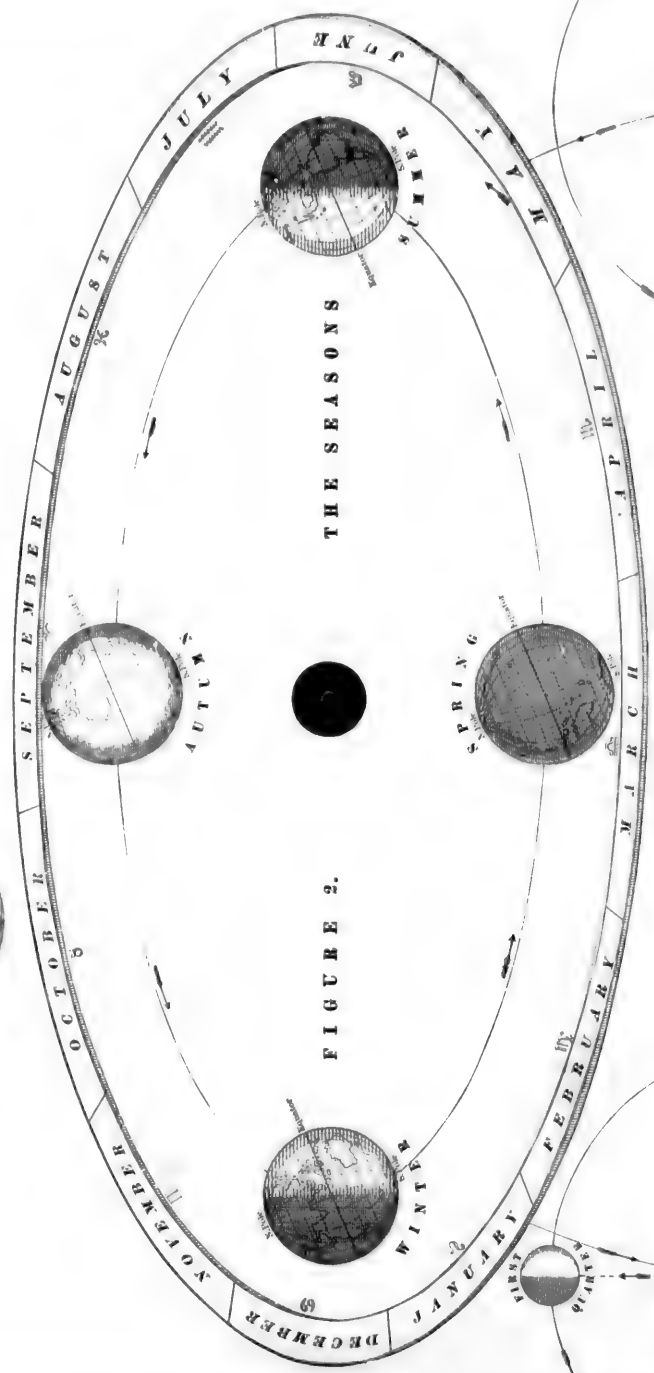


FIGURE 2.

THE SEASONS

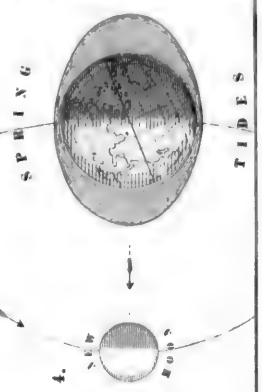


FIG. 4.

The Moon's Attraction
acts with that of the Sun

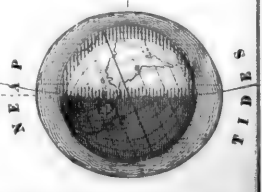


FIG. 3.

The Moon's Attraction
acts against that of the Sun

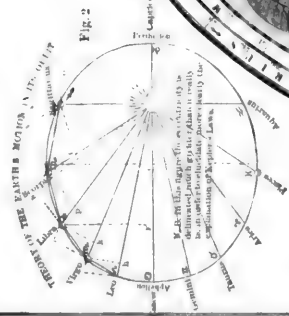


FIG. 1.

The Earth revolves round the Sun in an elliptical orbit, which is about 93 million miles in length. The Earth's axis is inclined at an angle of about 23.5 degrees to the perpendicular of its orbit. This inclination causes the seasons. As the Earth revolves, different parts of the Earth receive different amounts of sunlight, leading to the four seasons: Spring, Summer, Autumn, and Winter. The diagram shows the Earth at different points in its orbit, illustrating how the tilt of the axis affects the distribution of sunlight.

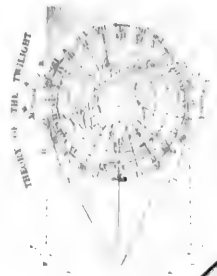


FIG. 3.

Apparent position of the Sun at different points in its orbit as seen from the Earth.

FIG. 2.

The Earth's axis is inclined at an angle of about 23.5 degrees to the perpendicular of its orbit. This inclination causes the seasons. As the Earth revolves, different parts of the Earth receive different amounts of sunlight, leading to the four seasons: Spring, Summer, Autumn, and Winter. The diagram shows the Earth at different points in its orbit, illustrating how the tilt of the axis affects the distribution of sunlight.

The Earth's axis is inclined at an angle of about 23.5 degrees to the perpendicular of its orbit. This inclination causes the seasons. As the Earth revolves, different parts of the Earth receive different amounts of sunlight, leading to the four seasons: Spring, Summer, Autumn, and Winter. The diagram shows the Earth at different points in its orbit, illustrating how the tilt of the axis affects the distribution of sunlight.

ANTARCTIC
TROPIC OF CANCER
EQUATOR
TROPIC OF CAPRICORN
ARCTIC

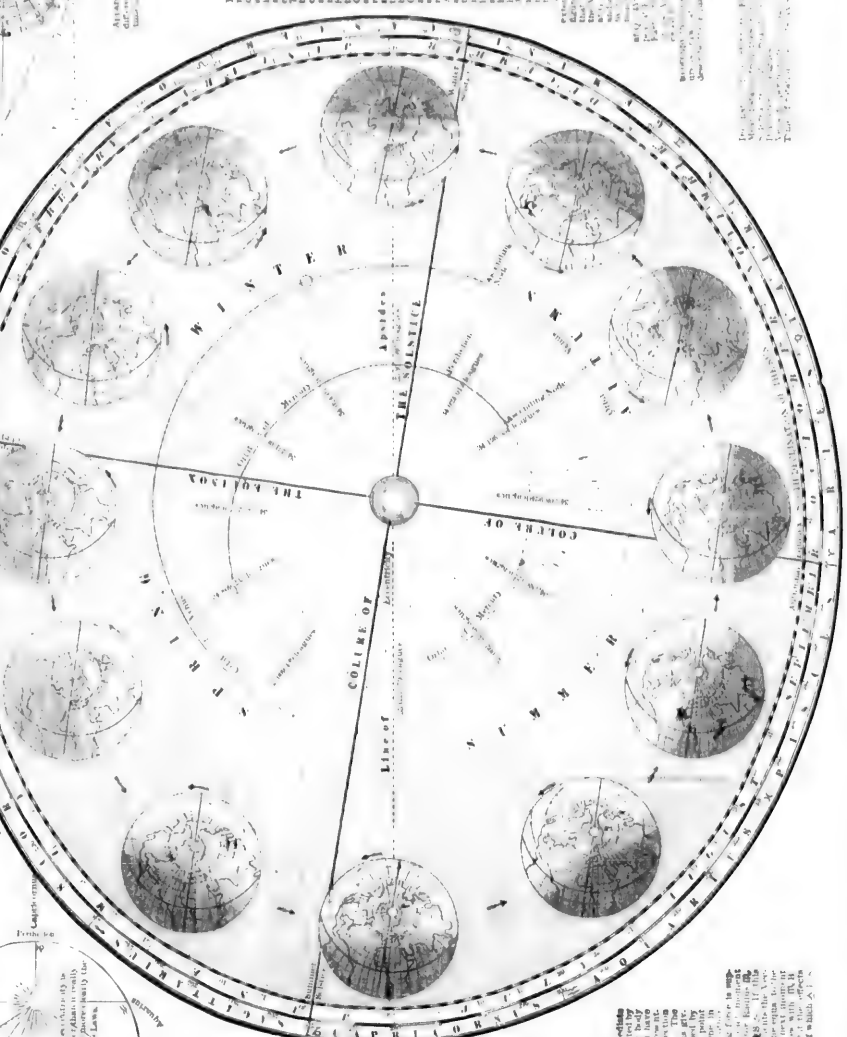


FIG. 2.

The Earth's axis is inclined at an angle of about 23.5 degrees to the perpendicular of its orbit. This inclination causes the seasons. As the Earth revolves, different parts of the Earth receive different amounts of sunlight, leading to the four seasons: Spring, Summer, Autumn, and Winter. The diagram shows the Earth at different points in its orbit, illustrating how the tilt of the axis affects the distribution of sunlight.

TIME OF THE MOON'S REVOLUTIONS

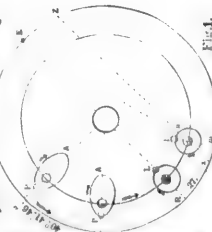
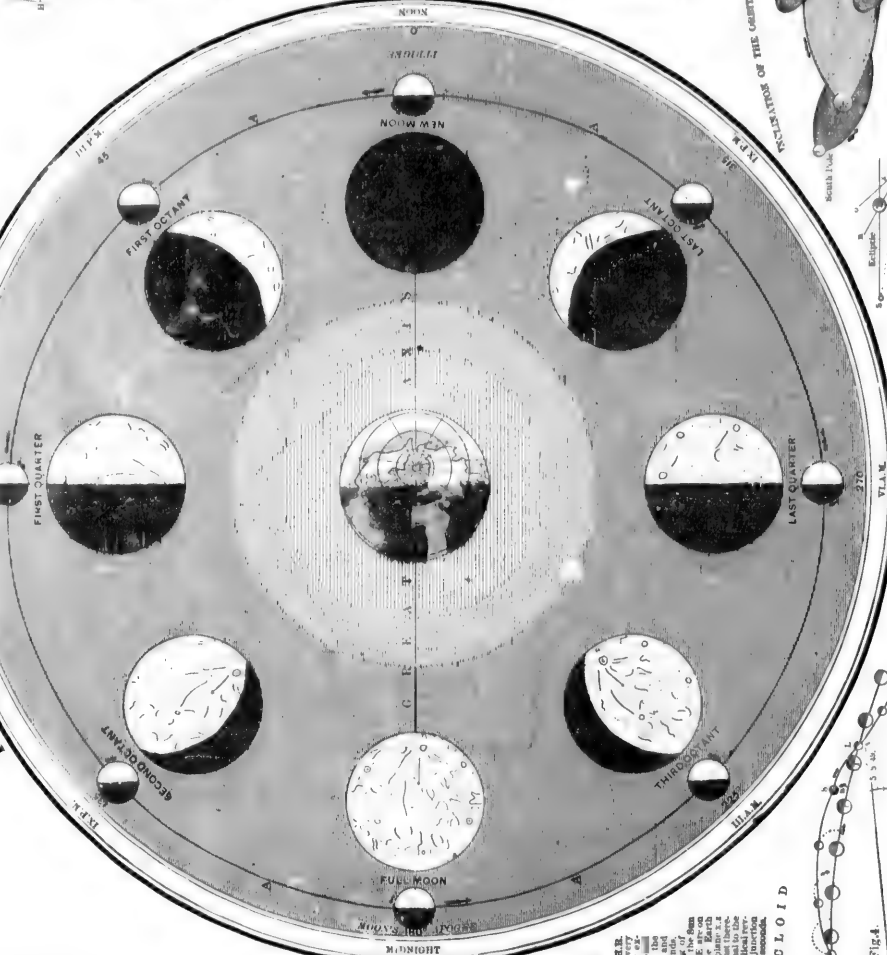


Fig. 1.

The Moon's orbit around the Earth is elliptical, and the Earth's orbit around the Sun is also elliptical. The Moon's path is indicated by a line labeled A, A, A, A. The Earth is at the center, and the Sun is at the focus. The Moon's orbit is elliptical, and the Earth's orbit is also elliptical. The diagram shows the Moon's position at various points in its orbit, including the New Moon, First Quarter, Full Moon, and Last Quarter.

PHASES AND MOVEMENTS OF THE MOON



LUNAR EPICYCLOID

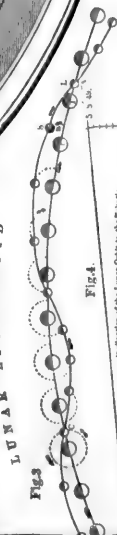


Fig. 4.

Perigee of the Lunar Orbit to the Equator

JOURNAL OF THE MOON

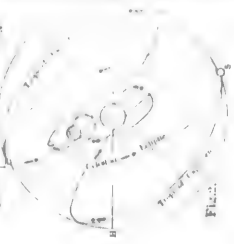


Fig. 2.

The Moon revolves around the Earth and the Earth revolves around the Sun. The Moon's path is indicated by a line labeled A, A, A, A. The Earth is at the center, and the Sun is at the focus. The Moon's orbit is elliptical, and the Earth's orbit is also elliptical. The diagram shows the Moon's position at various points in its orbit, including the New Moon, First Quarter, Full Moon, and Last Quarter.

MOVEMENTS OF THE GREAT LIPPER, MOVEMENT OF THE MOON

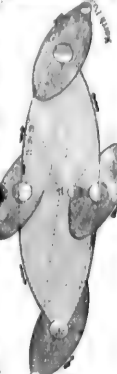
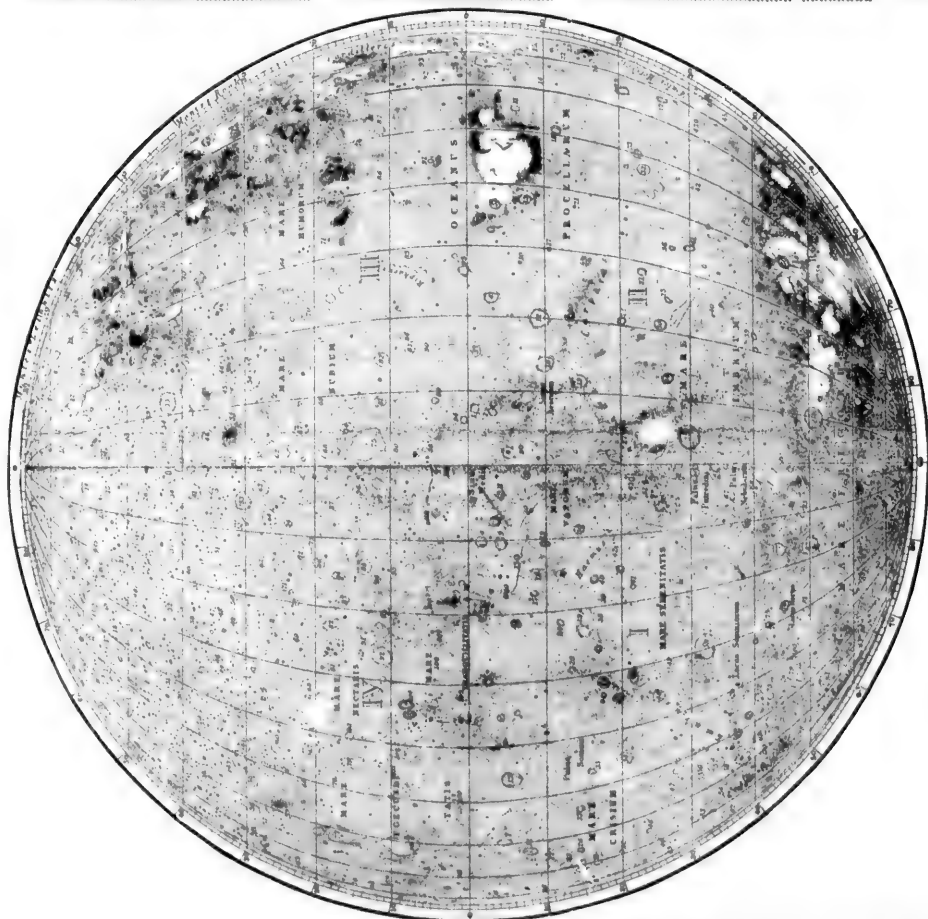


Fig. 3.



Fig. 5.

TELEGRAPHIC MAP OF THE WHOLE VISIBLE HEMISPHERE OF THE MOON.

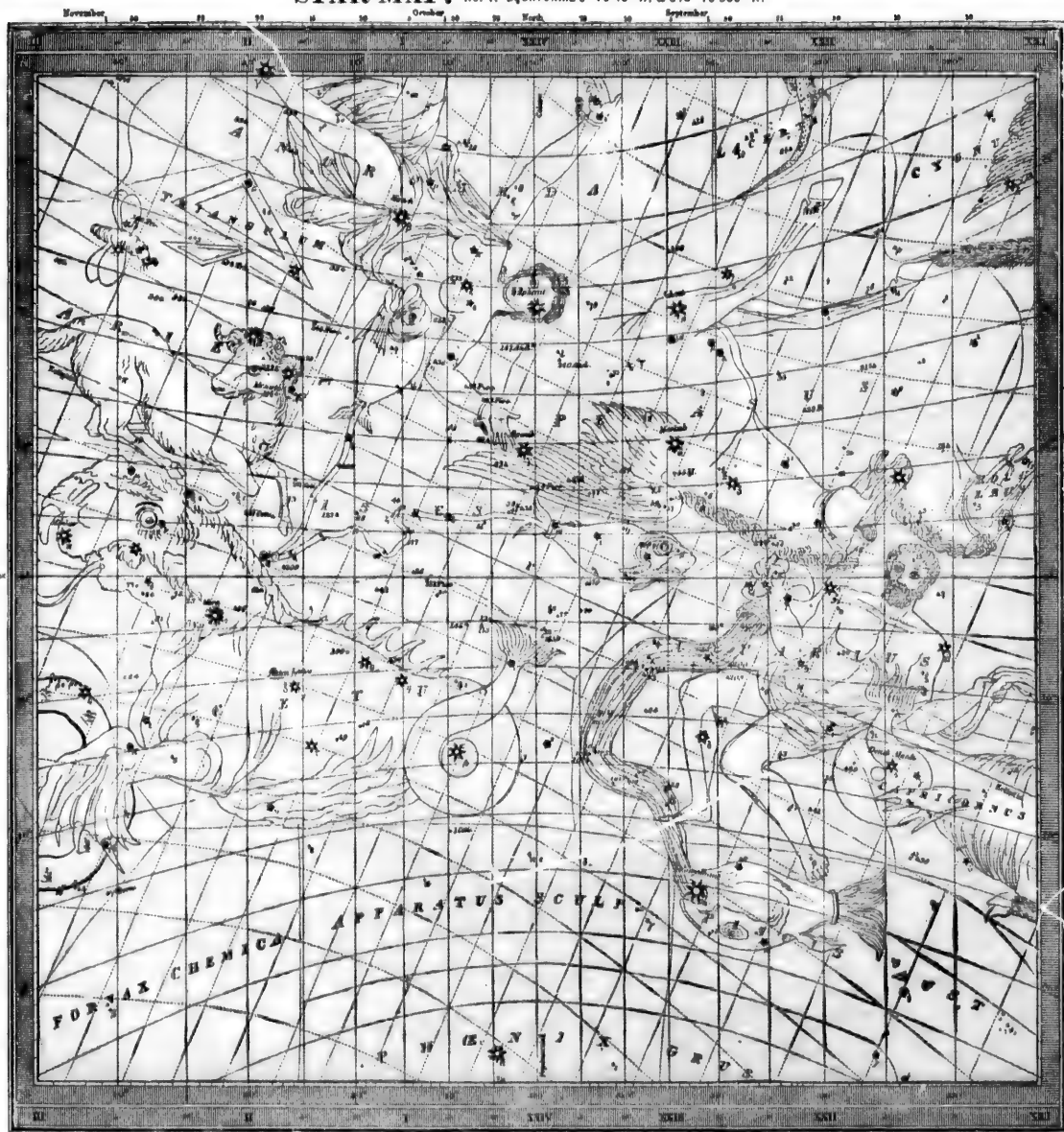


In order to understand the phenomena exhibited by the Moon the most careful and accurate observations of every part of the lunar disk is required at all the various periods of her illumination. The position of remarkable spots must be determined with the most rigorous exactness, as it is found, from the change of situation relative to surrounding appearances, consequent upon the Moon's position, that, a spot clearly distinguishable the naked eye upon her surface, when at the full, will be with difficulty discerned even by the glass towards the last quarter.

The appearances observed on the Moon's surface are caused either by difference of level, or by difference of the intensity of the light. The light reflected from the surface of the Moon is plainly seen to be of different shades; although the lighter parts are generally the mountains and the darker ones the low plains, still, careful observations have shown that this is not always the case, but that the crevices of light, which at the full appear in brilliancy all the adjacent parts, sometimes exist entirely independent of mountains, and extend also over heights and valleys without being affected by them. Besides difference in intensity of the light, colors especially different may be observed, particularly green, sometimes a color of a reddish tint, at others a yellowish brown. The directions of the Moon are in general of a much more precipitous nature than those of the earth. In the plains, the edges of the deeper craters, more especially those of small extent, are generally shown by a plain line, the narrow cliffs or ravines by parallel lines without a crease tint. The middle edge of the Moon (i. e. the great circle which in the moon's horizon separates the hemisphere which is visible from that which is invisible) is uncommonly delineated in profile. Chains of mountains, or mountainous regions of any importance, are almost always visible on the Moon, and the various spots other distinguished marks, are unaltered. To avoid confusing the objects in the plain by a profusion of figures, the Moon's surface is divided into four parts, the numbering of the spots in each commencing with unit.

I			
23	Proxima	49	Franklin
24	Mare Crisium	50	Franklin
25	Mare Crisium	51	Franklin
26	Mare Crisium	52	Franklin
27	Mare Crisium	53	Franklin
28	Mare Crisium	54	Franklin
29	Mare Crisium	55	Franklin
30	Mare Crisium	56	Franklin
31	Mare Crisium	57	Franklin
32	Mare Crisium	58	Franklin
33	Mare Crisium	59	Franklin
34	Mare Crisium	60	Franklin
35	Mare Crisium	61	Franklin
36	Mare Crisium	62	Franklin
37	Mare Crisium	63	Franklin
38	Mare Crisium	64	Franklin
39	Mare Crisium	65	Franklin
40	Mare Crisium	66	Franklin
41	Mare Crisium	67	Franklin
42	Mare Crisium	68	Franklin
43	Mare Crisium	69	Franklin
44	Mare Crisium	70	Franklin
45	Mare Crisium	71	Franklin
46	Mare Crisium	72	Franklin
47	Mare Crisium	73	Franklin
48	Mare Crisium	74	Franklin
49	Mare Crisium	75	Franklin
50	Mare Crisium	76	Franklin
51	Mare Crisium	77	Franklin
52	Mare Crisium	78	Franklin
53	Mare Crisium	79	Franklin
54	Mare Crisium	80	Franklin
55	Mare Crisium	81	Franklin
56	Mare Crisium	82	Franklin
57	Mare Crisium	83	Franklin
58	Mare Crisium	84	Franklin
59	Mare Crisium	85	Franklin
60	Mare Crisium	86	Franklin
61	Mare Crisium	87	Franklin
62	Mare Crisium	88	Franklin
63	Mare Crisium	89	Franklin
64	Mare Crisium	90	Franklin
65	Mare Crisium	91	Franklin
66	Mare Crisium	92	Franklin
67	Mare Crisium	93	Franklin
68	Mare Crisium	94	Franklin
69	Mare Crisium	95	Franklin
70	Mare Crisium	96	Franklin
71	Mare Crisium	97	Franklin
72	Mare Crisium	98	Franklin
73	Mare Crisium	99	Franklin
74	Mare Crisium	100	Franklin
75	Mare Crisium	101	Franklin
76	Mare Crisium	102	Franklin
77	Mare Crisium	103	Franklin
78	Mare Crisium	104	Franklin
79	Mare Crisium	105	Franklin
80	Mare Crisium	106	Franklin
81	Mare Crisium	107	Franklin
82	Mare Crisium	108	Franklin
83	Mare Crisium	109	Franklin
84	Mare Crisium	110	Franklin
85	Mare Crisium	111	Franklin
86	Mare Crisium	112	Franklin
87	Mare Crisium	113	Franklin
88	Mare Crisium	114	Franklin
89	Mare Crisium	115	Franklin
90	Mare Crisium	116	Franklin
91	Mare Crisium	117	Franklin
92	Mare Crisium	118	Franklin
93	Mare Crisium	119	Franklin
94	Mare Crisium	120	Franklin
95	Mare Crisium	121	Franklin
96	Mare Crisium	122	Franklin
97	Mare Crisium	123	Franklin
98	Mare Crisium	124	Franklin
99	Mare Crisium	125	Franklin
100	Mare Crisium	126	Franklin
101	Mare Crisium	127	Franklin
102	Mare Crisium	128	Franklin
103	Mare Crisium	129	Franklin
104	Mare Crisium	130	Franklin
105	Mare Crisium	131	Franklin
106	Mare Crisium	132	Franklin
107	Mare Crisium	133	Franklin
108	Mare Crisium	134	Franklin
109	Mare Crisium	135	Franklin
110	Mare Crisium	136	Franklin
111	Mare Crisium	137	Franklin
112	Mare Crisium	138	Franklin
113	Mare Crisium	139	Franklin
114	Mare Crisium	140	Franklin
115	Mare Crisium	141	Franklin
116	Mare Crisium	142	Franklin
117	Mare Crisium	143	Franklin
118	Mare Crisium	144	Franklin
119	Mare Crisium	145	Franklin
120	Mare Crisium	146	Franklin
121	Mare Crisium	147	Franklin
122	Mare Crisium	148	Franklin
123	Mare Crisium	149	Franklin
124	Mare Crisium	150	Franklin
125	Mare Crisium	151	Franklin
126	Mare Crisium	152	Franklin
127	Mare Crisium	153	Franklin
128	Mare Crisium	154	Franklin
129	Mare Crisium	155	Franklin
130	Mare Crisium	156	Franklin
131	Mare Crisium	157	Franklin
132	Mare Crisium	158	Franklin
133	Mare Crisium	159	Franklin
134	Mare Crisium	160	Franklin
135	Mare Crisium	161	Franklin
136	Mare Crisium	162	Franklin
137	Mare Crisium	163	Franklin
138	Mare Crisium	164	Franklin
139	Mare Crisium	165	Franklin
140	Mare Crisium	166	Franklin
141	Mare Crisium	167	Franklin
142	Mare Crisium	168	Franklin
143	Mare Crisium	169	Franklin
144	Mare Crisium	170	Franklin
145	Mare Crisium	171	Franklin
146	Mare Crisium	172	Franklin
147	Mare Crisium	173	Franklin
148	Mare Crisium	174	Franklin
149	Mare Crisium	175	Franklin
150	Mare Crisium	176	Franklin
151	Mare Crisium	177	Franklin
152	Mare Crisium	178	Franklin
153	Mare Crisium	179	Franklin
154	Mare Crisium	180	Franklin
155	Mare Crisium	181	Franklin
156	Mare Crisium	182	Franklin
157	Mare Crisium	183	Franklin
158	Mare Crisium	184	Franklin
159	Mare Crisium	185	Franklin
160	Mare Crisium	186	Franklin
161	Mare Crisium	187	Franklin
162	Mare Crisium	188	Franklin
163	Mare Crisium	189	Franklin
164	Mare Crisium	190	Franklin
165	Mare Crisium	191	Franklin
166	Mare Crisium	192	Franklin
167	Mare Crisium	193	Franklin
168	Mare Crisium	194	Franklin
169	Mare Crisium	195	Franklin
170	Mare Crisium	196	Franklin
171	Mare Crisium	197	Franklin
172	Mare Crisium	198	Franklin
173	Mare Crisium	199	Franklin
174	Mare Crisium	200	Franklin
175	Mare Crisium	201	Franklin
176	Mare Crisium	202	Franklin
177	Mare Crisium	203	Franklin
178	Mare Crisium	204	Franklin
179	Mare Crisium	205	Franklin
180	Mare Crisium	206	Franklin
181	Mare Crisium	207	Franklin
182	Mare Crisium	208	Franklin
183	Mare Crisium	209	Franklin
184	Mare Crisium	210	Franklin
185	Mare Crisium	211	Franklin
186	Mare Crisium	212	Franklin
187	Mare Crisium	213	Franklin
188	Mare Crisium	214	Franklin
189	Mare Crisium	215	Franklin
190	Mare Crisium	216	Franklin
191	Mare Crisium	217	Franklin
192	Mare Crisium	218	Franklin
193	Mare Crisium	219	Franklin
194	Mare Crisium	220	Franklin
195	Mare Crisium	221	Franklin
196	Mare Crisium	222	Franklin
197	Mare Crisium	223	Franklin
198	Mare Crisium	224	Franklin
199	Mare Crisium	225	Franklin
200	Mare Crisium	226	Franklin
201	Mare Crisium	227	Franklin
202	Mare Crisium	228	Franklin
203	Mare Crisium	229	Franklin
204	Mare Crisium	230	Franklin
205	Mare Crisium	231	Franklin
206	Mare Crisium	232	Franklin
207	Mare Crisium	233	Franklin
208	Mare Crisium	234	Franklin
209	Mare Crisium	235	Franklin
210	Mare Crisium	236	Franklin
211	Mare Crisium	237	Franklin
212	Mare Crisium	238	Franklin
213	Mare Crisium	239	Franklin
214	Mare Crisium	240	Franklin
215	Mare Crisium	241	Franklin
216	Mare Crisium	242	Franklin
217	Mare Crisium	243	Franklin
218	Mare Crisium	244	Franklin
219	Mare Crisium	245	Franklin
220	Mare Crisium	246	Franklin
221	Mare Crisium	247	Franklin
222	Mare Crisium	248	Franklin
223	Mare Crisium	249	Franklin
224	Mare Crisium	250	Franklin
225	Mare Crisium	251	Franklin
226	Mare Crisium	252	Franklin
227	Mare Crisium	253	Franklin
228	Mare Crisium	254	Franklin
229	Mare Crisium	255	Franklin
230	Mare Crisium	256	Franklin
231	Mare Crisium	257	Franklin
232	Mare Crisium	258	Franklin
233	Mare Crisium	259	Franklin
234	Mare Crisium	260	Franklin
235	Mare Crisium	261	Franklin
236	Mare Crisium	262	Franklin
237	Mare Crisium	263	Franklin
238	Mare Crisium	264	Franklin
239	Mare Crisium	265	Franklin
240	Mare Crisium	266	Franklin
241	Mare Crisium	267	Franklin
242	Mare Crisium	268	Franklin
243	Mare Crisium	269	Franklin
244	Mare Crisium	270	Franklin
245	Mare Crisium	271	Franklin
246	Mare Crisium	272	Franklin
247	Mare Crisium	273	Franklin
248	Mare Crisium	274	Franklin
249	Mare Crisium	275	Franklin
250	Mare Crisium	276	Franklin
251	Mare Crisium	277	Franklin
252	Mare Crisium	278	Franklin
253	Mare Crisium	279	Franklin
254	Mare Crisium	280	Franklin
255	Mare Crisium	281	Franklin
256	Mare Crisium	282	Franklin
257	Mare Crisium	283	Franklin
258	Mare Crisium	284	Franklin
259	Mare Crisium	285	Franklin
260	Mare Crisium	286	Franklin
261	Mare Crisium	287	Franklin
262	Mare Crisium	288	Franklin
263	Mare Crisium	289	Franklin
264	Mare Crisium	290	Franklin
265	Mare Crisium	291	Franklin
266	Mare Crisium	292	Franklin
267	Mare Crisium	293	Franklin
268	Mare Crisium	294	Franklin
269	Mare Crisium	295	Franklin
270	Mare Crisium	296	Franklin
271	Mare Crisium	297	Franklin
272	Mare Crisium	298	Franklin
273	Mare Crisium	299	Franklin
274	Mare Crisium	300	Franklin
275	Mare Crisium	301	Franklin
276	Mare Crisium	302	Franklin
277	Mare Crisium	303	Franklin
278	Mare Crisium	304	Franklin
279	Mare Crisium	305	Franklin
280	Mare Crisium	306	Franklin
281	Mare Crisium	307	Franklin
282	Mare Crisium	308	Franklin
283	Mare Crisium	309	Franklin
284	Mare Crisium	310	Franklin
285	Mare Crisium	311	Franklin
286	Mare Crisium	312	Franklin
287	Mare Crisium	313	Franklin
288	Mare Crisium	314	Franklin
289	Mare Crisium	315	Franklin
290	Mare Crisium	316	Franklin
291	Mare Crisium	317	Franklin
292	Mare Crisium	318	Franklin
293	Mare Crisium	319	Franklin
294	Mare Crisium	320	Franklin
295	Mare Crisium	321	Franklin
296	Mare Crisium	322	Franklin
297	Mare Crisium	323	Franklin
298	Mare Crisium	324	Franklin
299	Mare Crisium	325	Franklin
300	Mare Crisium	326	Franklin
301	Mare Crisium	327	Franklin
302	Mare Crisium	328	Franklin
303	Mare Crisium	329	Franklin
304	Mare Crisium	330	Franklin
305	Mare Crisium	331	Franklin
306	Mare Crisium	332	Franklin
307	Mare Crisium	333	Franklin
308	Mare Crisium	334	Franklin
309	Mare Crisium	335	Franklin
310	Mare Crisium	336	Franklin
311	Mare Crisium	337	Franklin
312	Mare Crisium	338	Franklin
313	Mare Crisium	339	Franklin
314	Mare Crisium	340	Franklin
315	Mare Crisium	341	Franklin
316	Mare Crisium	342	Franklin
317	Mare Crisium	343	Franklin
318	Mare Crisium	344	Franklin
319	Mare Crisium	345	Franklin
320	Mare Crisium	346	Franklin
321	Mare Crisium	347	Franklin
322	Mare Crisium	348	Franklin
323	Mare Crisium	349	Franklin
324	Mare Crisium	350	Franklin
325	Mare Crisium	351	Franklin
326	Mare Crisium	352	Franklin
327	Mare Crisium	353	Franklin
328	Mare Crisium	354	Franklin
329	Mare Crisium	355	Franklin
330	Mare Crisium	356	Franklin
331	Mare Crisium	357	Franklin
332	Mare Crisium	358	Franklin
333	Mare Crisium	359	Franklin
334	Mare Crisium	360	Franklin
335	Mare Crisium	361	Franklin
336	Mare Crisium	362	Franklin
337	Mare Crisium	363	Franklin
338	Mare Crisium	364	Franklin
339	Mare Crisium	365	Franklin
340	Mare Crisium	366	Franklin
341	Mare Crisium	367	Franklin
342	Mare Crisium	368	Franklin
343	Mare Crisium	369	Franklin
344	Mare Crisium	370	Franklin
345	Mare Crisium	371	Franklin
346	Mare Crisium	372	Franklin
347	Mare Crisium	373	Franklin
348	Mare Crisium	374	Franklin
349	Mare Crisium	375	Franklin
350	Mare Crisium	376	Franklin
351	Mare Crisium	377	Franklin
352	Mare Crisium	378	Franklin
353	Mare Crisium	379	Franklin
354	Mare Crisium	380	Franklin
355	Mare Crisium	381	Franklin
356	Mare Crisium	382	Franklin
357	Mare Crisium	383	Franklin
358	Mare Crisium	384	Franklin
359	Mare Crisium	385	Franklin
360	Mare Crisium	386	Franklin
361	Mare Crisium	387	Franklin
362	Mare Crisium	388	Franklin
363	Mare Crisium	389	Franklin
364	Mare Crisium	390	Franklin
365	Mare Crisium	391	Franklin
366	Mare Crisium	392	Franklin
367	Mare Crisium	393	Franklin
368	Mare Crisium	394	Franklin
369	Mare Crisium	395	Franklin
370			

STAR MAP. NO. 1. EQUATORIAL TO 45° W. & 315 TO 360° W.



CONSTELLATIONS are the groups into which the fixed stars are divided; this division was begun in ancient times, and Ptolemy enumerates forty-eight constellations, viz:—The twelve signs of the zodiac, twenty-one in the northern hemisphere, and fifteen in the southern hemisphere. Those in the northern are, the Great Bear, the Little Bear, Perseus, the Dragon, Cepheus, Cassiopeia, Andromeda, Pegasus, the Little Horse, the Triangle, the Waggoner, Boötes, the Northern Crown, Ophiuchus, the Serpent, Hercules, the Arrow, the Lyre, the Swan, the Dolphin, the Eagle; and those in the southern hemisphere are, Orion, the Whale, Eridanus, the Harp, the Great Dog, the Little Dog, Hydra, the Cup, the Crow, the Centaur, the Wolf, the Altar, the Southern Fish, the Argo, and the Southern Crown. These constellations are still retained, but since Ptolemy's time many others have been added, more particularly in the southern hemisphere.

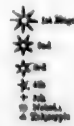
The more important stars in each constellation are designated by Greek letters, the brightest usually by α (Alpha), the next in order of brightness by β (Beta) the third by γ (Gamma), and the fourth by δ (Delta), and so on: thus on Map 1, near its left hand boundary, a little above the equator, the brightest star in Orion with the name "Betelgeuse" has also a near to it; the designation of this star is therefore α Ori, and within the curl of the tail of Orion is the star γ Ori. Still further to the right and lower down, nearly on the line joining α Ori and β Ori continued, is a star in Pictus Australis, Pomekan, also with α attached;

the designation of this star is therefore α Pictus Australis. Several stars in the maps have, in addition to their designations by means of Greek letters and constellations, particular names by which they have been long known, such as Menkar and Pomekan, in the first map, Castor and Pollux in the second map, &c.

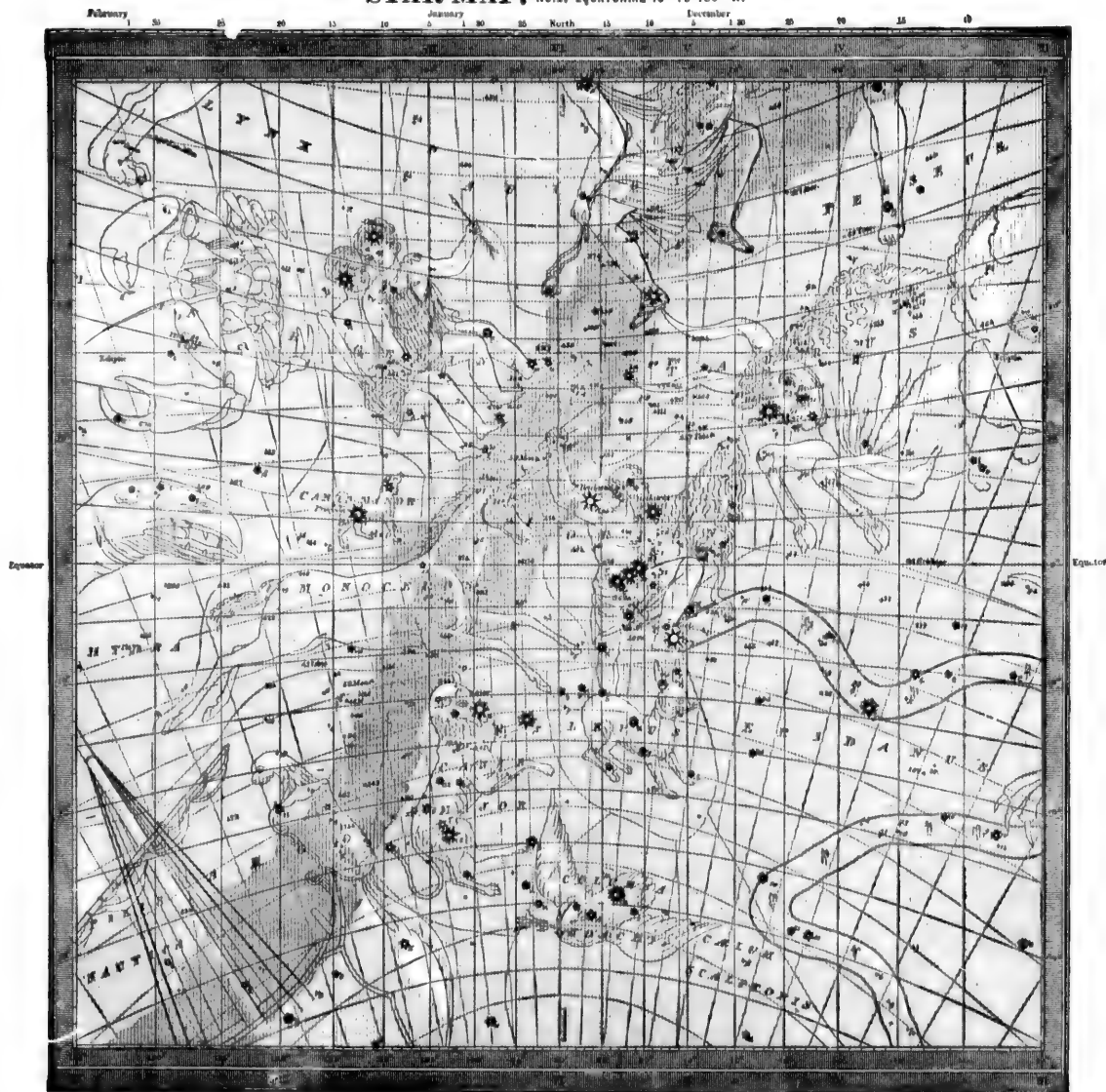
The line marked Equator in the maps separates the northern hemisphere from the southern hemisphere. Twice in the year the sun is on the equator, viz: at the beginning of spring and at the beginning of autumn, and at these times the lengths of the day and night are equal at all places on the earth; from this fact the name of Equator is derived.

The Declination of a star is its distance from the Equator measured in degrees, northward or southward; when the sun is on the equator, about March 20 and September 22, his declination is 0°; the greatest declination the sun can have is about 23½°; the declination of a star on the Equator is 0°, and of a star at the pole is 90°. The declinations are shown by curved lines separated from each other by 5°, and numbered at every 10° on each side of the maps.

The Right Ascension of a star is its distance from the equinoctial point γ (in the centre of Map 1) reckoned on the Equator eastward, and expressed either in degrees and minutes, from 0° to 360° (as shown on the inner boundary at the top and bottom of the maps) or in hours and minutes, from 0h to 24h (as shown on the outer boundary at the top and bottom.)



STAR MAP, NO. 2. EQUATORIAL 45 TO 135 W.

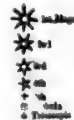


The line passing vertically through the centre of Map 1 (the equinoctial circle) is the line of right ascension 0°, and all lines parallel to this on the Maps 1, 2, 3, 4, are lines of right ascension. They are separated from each other by intervals of 30 minutes, thus all stars on the first line to the left of T are of right ascension 0° 30'; those on the second are of right ascension 0° 00'; those on the third are of right ascension 0° 30', and so on through Maps 1, 2, 3, 4, to the right hand side of Map 1, and so back to the equinoctial circle.

The position of a star, with respect to the Equator, is thus determined by the intersection of their lines of right ascension and declination.

The line marked *Ecliptic* is that great circle of the celestial sphere in which the sun appears to describe its path. It cuts the Equator in two points, viz., the first point of Aries (♈) and the first point of Libra (♎), which are respectively the centres of Maps 1 and 2. The vertical lines through these points are termed the equinoctial circles; as already mentioned, the sun passes through these points about March 20 and September 22. About June 21 the sun's northern declination is the greatest, and he is at the first point of Cancer, (marked ♋ on Map 2); and about December 21 his southern declination is greatest, and he is at the first point of Capricornus (marked ♐ on Map 4); the vertical lines through these points (which pass through the centres of Maps 2 and 4) are called the solstitial circles.

In Maps 1 and 2 the ecliptic is a twisted line passing through the centre of the map; in Maps 3 and 4 it is a line parallel to the equator, above it in Map 3 and below it in Map 4.

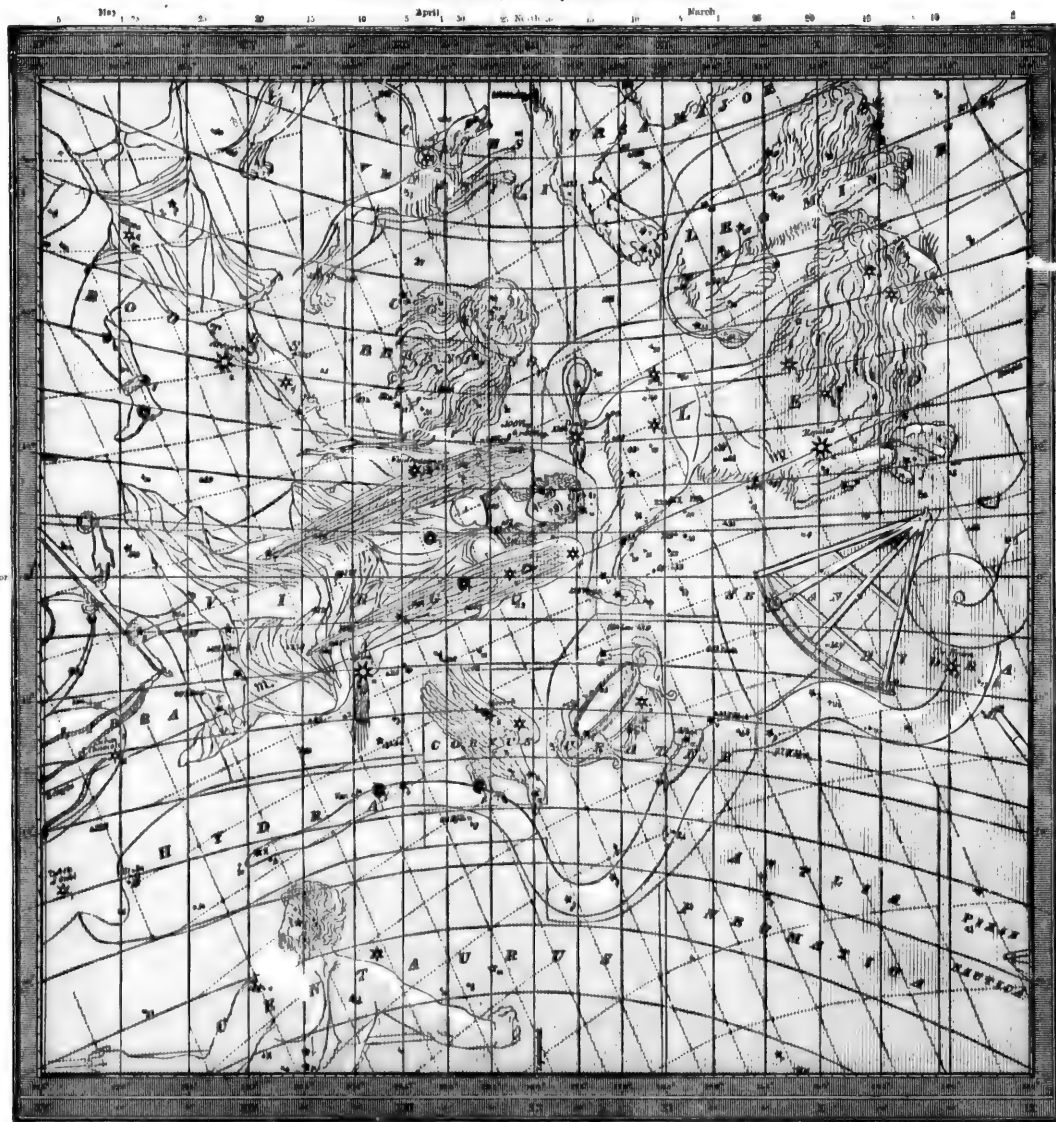


The twelve signs of the Zodiac are twelve equal arcs of 30° each, into which the ecliptic is divided; they are named from the twelve constellations through which the sun passes. Starting from the vernal equinox (T), whose longitude is 0°, and which occupies the centre of Map 1, and reckoning towards the east, the sun enters each sign in the following order:

About March 20 the sun enters Aries T, whose longitude is 0°				Map 1.
" April 30	" Taurus ♉	" 30°	"	"
" May 21	" Gemini ♊	" 60°	"	"
" June 21	" Cancer ♋	" 90°	"	" 2.
" July 22	" Leo ♌	" 120°	"	"
" Aug. 23	" Virgo ♍	" 150°	"	"
" Sept. 23	" Libra ♎	" 180°	"	" 3.
" Oct. 23	" Scorpio ♏	" 210°	"	"
" Nov. 22	" Sagittarius ♐	" 240°	"	"
" Dec. 21	" Capricornus ♑	" 270°	"	" 4.
" Jan. 19	" Aquarius ♒	" 300°	"	"
" Feb. 18	" Pisces ♓	" 330°	"	" 1.

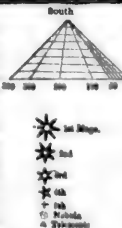
The Latitude of a star is its distance from the ecliptic, measured northward or southward in degrees and minutes. The latitudes are shown by dotted lines distant 5° from one another; they are more curved the further they are from the ecliptic.

STAR MAP. No.3. EQUATORIAL 135 TO 225 W.



The Longitude of a star is its distance from Υ measured along the ecliptic eastwards, and is expressed in degrees and minutes from 0° to 360° . The dotted line through Υ perpendicular to the ecliptic is the line of longitude 0° , and the dotted straight lines, distant 5° from one another, and which cut the lines of latitude, are the lines of longitude; for example, where the sixth line of longitude cuts the ecliptic (on Map 1) is found Υ , the longitude of which is therefore 0° , and so on throughout the twelve signs of the zodiac up to 360° .

The months and days of the year, which are placed on the upper border of the maps, denote the date at which the stars in the vertical lines under them will pass the meridian at midnight. Thus for example, from Map 1, Algenib (γ Pegasus) and Alpherat pass the meridian at midnight about September 23th. The manner in which these dates are obtained may be easily explained as follows: When the sun is on the equator on March 20 at the vernal equinox his longitude is 0° , and when he is on the equator on September 23 at the autumnal equinox his longitude is 180° . At the vernal equinox all the stars whose right ascension is to pass the meridian at the same time as the sun, and such stars six months afterwards will pass the meridian about twelve hours before the sun, &c. at midnight. The stars Algenib and Alpherat will, therefore, pass the meridian about noon on March 20, and about midnight on September 23.
























































As the sun's longitude increases by about 50° in a month, he approximately passes through one degree a day, therefore on the 31st of March he will be at the point where the first dotted line to the left of Υ cuts the ecliptic, and on the 23th where the second dotted line cuts the ecliptic, and so on. The sun's longitude on April 30 is 31° , and he is then at the first point of Taurus (γ); six days, therefore, which have nearly the same right ascension as this point (for example Υ Andromeda, α Arietis, β Arietis) pass the meridian at about noon on this day, and six months afterwards, on October 31, at about midnight, as shown by this date which appears at the top of the map.

The sun's place in the heavens can, therefore, be readily determined by the maps for every day in the year, and the stars which pass the meridian at about noon or midnight on every day can be similarly determined.

The difference between the right ascension of the sun and the right ascension of a star will give a rough approximation to the time of the passage of the latter across the meridian; thus, on March 20, when the sun's right ascension is 0° , marked XIV. on the maps, all stars, whose right ascension is 6 hours, 7 hours, 8 hours, &c., will be nearly due south at 6 p.m., 7 p.m., 8 p.m., &c.; for example, the sun enters Taurus about April 20; this point (see Map 1) is a little to the right of the two-hour line or right ascension (about nine minutes), therefore the sun's

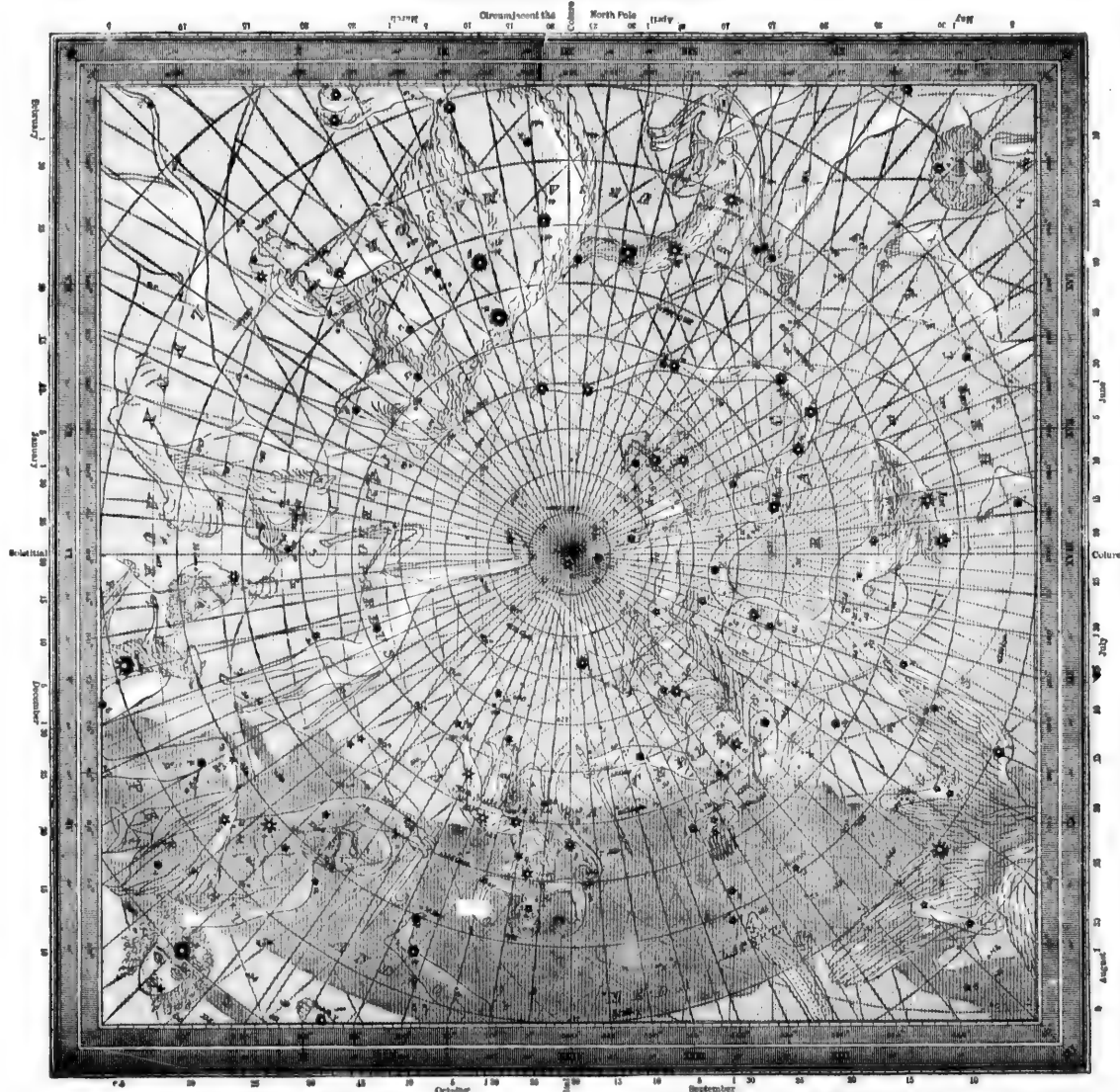
August 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125 130 135 140 145 150 155 160 165 170 175 180 185 190 195 200 205 210 215 220 225 230 235 240 245 250 255 260 265 270 275 280 285 290 295 300 305 310 315 320 325 330 335 340 345 350 355 360 365 370 375 380 385 390 395 400 405 410 415 420 425 430 435 440 445 450 455 460 465 470 475 480 485 490 495 500 505 510 515 520 525 530 535 540 545 550 555 560 565 570 575 580 585 590 595 600 605 610 615 620 625 630 635 640 645 650 655 660 665 670 675 680 685 690 695 700 705 710 715 720 725 730 735 740 745 750 755 760 765 770 775 780 785 790 795 800 805 810 815 820 825 830 835 840 845 850 855 860 865 870 875 880 885 890 895 900 905 910 915 920 925 930 935 940 945 950 955 960 965 970 975 980 985 990 995 1000 1005 1010 1015 1020 1025 1030 1035 1040 1045 1050 1055 1060 1065 1070 1075 1080 1085 1090 1095 1100 1105 1110 1115 1120 1125 1130 1135 1140 1145 1150 1155 1160 1165 1170 1175 1180 1185 1190 1195 1200 1205 1210 1215 1220 1225 1230 1235 1240 1245 1250 1255 1260 1265 1270 1275 1280 1285 1290 1295 1300 1305 1310 1315 1320 1325 1330 1335 1340 1345 1350 1355 1360 1365 1370 1375 1380 1385 1390 1395 1400 1405 1410 1415 1420 1425 1430 1435 1440 1445 1450 1455 1460 1465 1470 1475 1480 1485 1490 1495 1500 1505 1510 1515 1520 1525 1530 1535 1540 1545 1550 1555 1560 1565 1570 1575 1580 1585 1590 1595 1600 1605 1610 1615 1620 1625 1630 1635 1640 1645 1650 1655 1660 1665 1670 1675 1680 1685 1690 1695 1700 1705 1710 1715 1720 1725 1730 1735 1740 1745 1750 1755 1760 1765 1770 1775 1780 1785 1790 1795 1800 1805 1810 1815 1820 1825 1830 1835 1840 1845 1850 1855 1860 1865 1870 1875 1880 1885 1890 1895 1900 1905 1910 1915 1920 1925 1930 1935 1940 1945 1950 1955 1960 1965 1970 1975 1980 1985 1990 1995 2000 2005 2010 2015 2020 2025 2030 2035 2040 2045 2050 2055 2060 2065 2070 2075 2080 2085 2090 2095 2100 2105 2110 2115 2120 2125 2130 2135 2140 2145 2150 2155 2160 2165 2170 2175 2180 2185 2190 2195 2200 2205 2210 2215 2220 2225 2230 2235 2240 2245 2250 2255 2260 2265 2270 2275 2280 2285 2290 2295 2300 2305 2310 2315 2320 2325 2330 2335 2340 2345 2350 2355 2360 2365 2370 2375 2380 2385 2390 2395 2400 2405 2410 2415 2420 2425 2430 2435 2440 2445 2450 2455 2460 2465 2470 2475 2480 2485 2490 2495 2500 2505 2510 2515 2520 2525 2530 2535 2540 2545 2550 2555 2560 2565 2570 2575 2580 2585 2590 2595 2600 2605 2610 2615 2620 2625 2630 2635 2640 2645 2650 2655 2660 2665 2670 2675 2680 2685 2690 2695 2700 2705 2710 2715 2720 2725 2730 2735 2740 2745 2750 2755 2760 2765 2770 2775 2780 2785 2790 2795 2800 2805 2810 2815 2820 2825 2830 2835 2840 2845 2850 2855 2860 2865 2870 2875 2880 2885 2890 2895 2900 2905 2910 2915 2920 2925 2930 2935 2940 2945 2950 2955 2960 2965 2970 2975 2980 2985 2990 2995 3000 3005 3010 3015 3020 3025 3030 3035 3040 3045 3050 3055 3060 3065 3070 3075 3080 3085 3090 3095 3100 3105 3110 3115 3120 3125 3130 3135 3140 3145 3150 3155 3160 3165 3170 3175 3180 3185 3190 3195 3200 3205 3210 3215 3220 3225 3230 3235 3240 3245 3250 3255 3260 3265 3270 3275 3280 3285 3290 3295 3300 3305 3310 3315 3320 3325 3330 3335 3340 3345 3350 3355 3360 3365 3370 3375 3380 3385 3390 3395 3400 3405 3410 3415 3420 3425 3430 3435 3440 3445 3450 3455 3460 3465 3470 3475 3480 3485 3490 3495 3500 3505 3510 3515 3520 3525 3530 3535 3540 3545 3550 3555 3560 3565 3570 3575 3580 3585 3590 3595 3600 3605 3610 3615 3620 3625 3630 3635 3640 3645 3650 3655 3660 3665 3670 3675 3680 3685 3690 3695 3700 3705 3710 3715 3720 3725 3730 3735 3740 3745 3750 3755 3760 3765 3770 3775 3780 3785 3790 3795 3800 3805 3810 3815 3820 3825 3830 3835 3840 3845 3850 3855 3860 3865 3870 3875 3880 3885 3890 3895 3900 3905 3910 3915 3920 3925 3930 3935 3940 3945 3950 3955 3960 3965 3970 3975 3980 3985 3990 3995 4000 4005 4010 4015 4020 4025 4030 4035 4040 4045 4050 4055 4060 4065 4070 4075 4080 4085 4090 4095 4100 4105 4110 4115 4120 4125 4130 4135 4140 4145 4150 4155 4160 4165 4170 4175 4180 4185 4190 4195 4200 4205 4210 4215 4220 4225 4230 4235 4240 4245 4250 4255 4260 4265 4270 4275 4280 4285 4290 4295 4300 4305 4310 4315 4320



 1st Degree
 2nd
 3rd
 4th
 5th
 6th
 7th
 8th
 9th
 10th
 11th
 12th
 13th
 14th
 15th
 16th
 17th
 18th
 19th
 20th
 21st
 22nd
 23rd
 24th
 25th
 26th
 27th
 28th
 29th
 30th
 31st
 32nd
 33rd
 34th
 35th
 36th
 37th
 38th
 39th
 40th
 41st
 42nd
 43rd
 44th
 45th
 46th
 47th
 48th
 49th
 50th
 51st
 52nd
 53rd
 54th
 55th
 56th
 57th
 58th
 59th
 60th
 61st
 62nd
 63rd
 64th
 65th
 66th
 67th
 68th
 69th
 70th
 71st
 72nd
 73rd
 74th
 75th
 76th
 77th
 78th
 79th
 80th
 81st
 82nd
 83rd
 84th
 85th
 86th
 87th
 88th
 89th
 90th
 91st
 92nd
 93rd
 94th
 95th
 96th
 97th
 98th
 99th
 100th
 101st
 102nd
 103rd
 104th
 105th
 106th
 107th
 108th

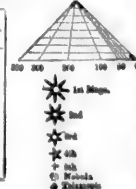
The positions of the principal slates in each of the maps for the year 1966 are given in the following table, and the change in position of the slates can be ascertained by comparing the positions of the slates on 1966 maps with their positions on those of 1965.

STAR MAP. No. 5, NORTH POLAR



LIST OF THE PRINCIPAL STARS IN THE CONSTELLATIONS OF THE ZODIAC.

CONSTELLATIONS.	NAMES OF STARS.	Right Ascension, Jan. 1, 1885.	Declination, Jan. 1, 1885.	Magn.
Aries	α Arietis	21. 50. 00	30. 00. 00	1
Taurus	α Tauri	4. 00. 00	16. 30. 00	1
Gemini	α Geminorum	7. 27. 00	8. 00. 00	2
Cancer	α Canceri	8. 50. 00	18. 00. 00	2
Leo	α Leonis	10. 00. 00	12. 00. 00	2
Virgo	α Virginis	13. 19. 00	10. 00. 00	2
Libra	α Libræ	14. 44. 00	15. 00. 00	2
Scorpius	α Scorpionis	16. 32. 00	10. 00. 00	2
Sagittarius	α Sagittarii	18. 47. 00	10. 00. 00	2
Capricornus	α Capricorni	20. 12. 00	10. 00. 00	2
Aquarius	α Aquarii	21. 50. 00	10. 00. 00	2
Pisces	α Piscium	23. 00. 00	10. 00. 00	2



The maps are drawn on the gnomonic projection; in Nos. 1, 2, 3 and 4, the plan of projection is taken parallel to the axis of the earth; in Nos. 5 and 6 it is taken perpendicular to the axis of the earth.

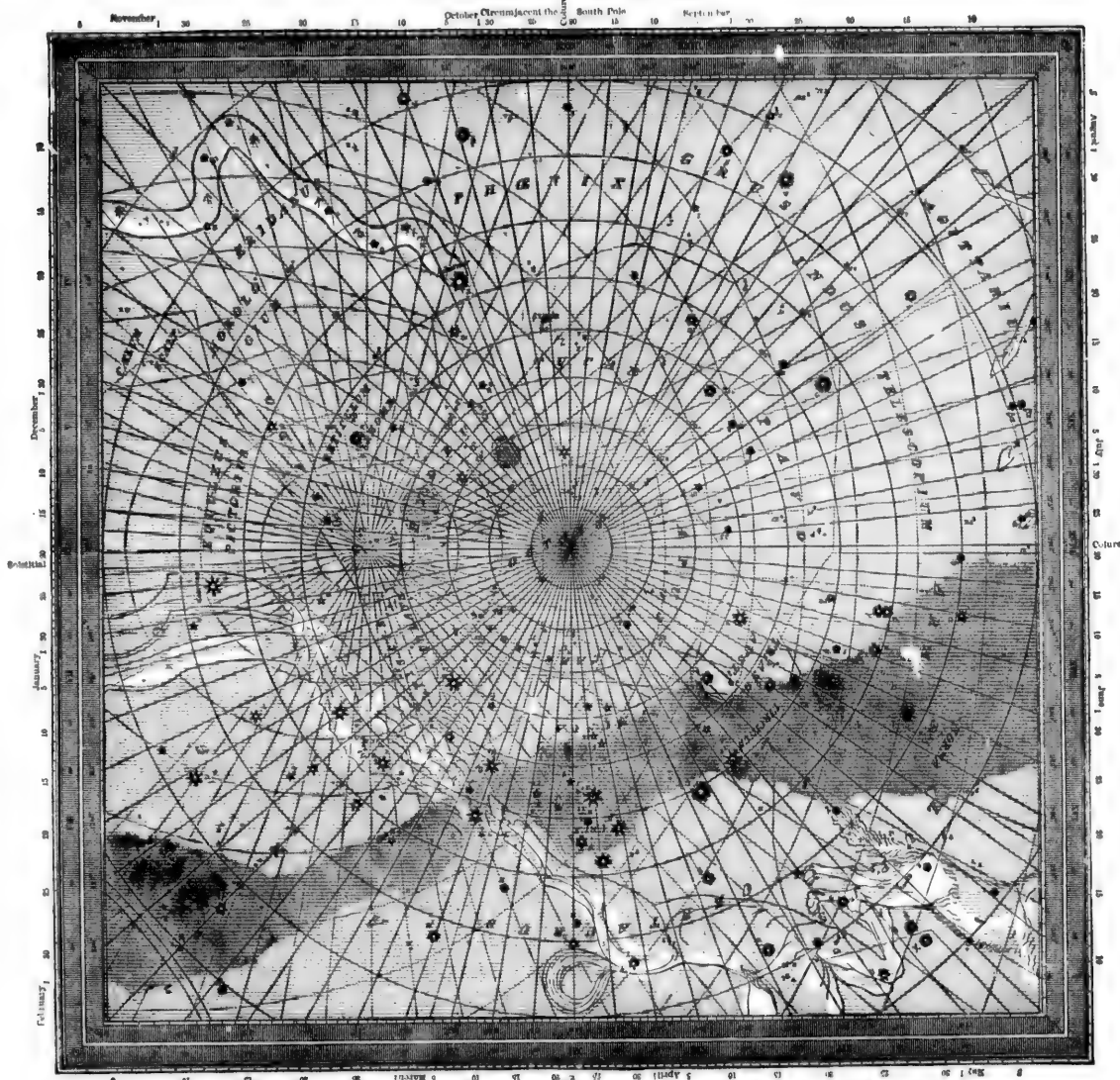
The centres of Maps 1 and 2 are respectively the first points of Aries and Libra, and the centres of Maps 3 and 4 are respectively the points mid-way between these two points on the equator; in Maps 5 and 6 the centres are of course the north pole and south pole respectively.

In Maps 1, 2, 3 and 4, the meridians are projected into parallel straight lines, and the parallels of declination are portions of hyperbolæ; in Maps 5 and 6 the meridians are projected into straight lines radiating from the pole, whilst the parallels of declination are projected into concentric circles.

By this projection all stars which lie on the same great circle in the heavens are in the same straight line on the maps.

The maps include all the larger stars and nearly all those which can be seen by the naked eye; their magnitudes are indicated by the number of petals of the asterisk; a star of the first magnitude has eight petals, a star of the second magnitude seven petals, and so on.

STAR MAP. No. 6. SOUTH POLAR.



LIST OF THE PRINCIPAL STARS IN THE
CONSTELLATIONS ON THE NORTH
SIDE OF THE EQUATOR.

CONSTELLATIONS.	NAMES OF STARS.	Right Ascension, Jan. 1, 1885.	Declination, Jan. 1, 1885.	Map.
Andromeda.....	Alpheratz.....	01 38 54	34 32 40	1
Cassiopeia.....	Cassiopeia.....	00 50 50	56 53 43	1
Ursa Minor.....	Polaris.....	01 15 30	89 01 33	3
Perseus.....	Algenet.....	03 15 36	49 38 30	3
Auriga.....	Capella.....	05 16 33	45 58 30	3
Ursa Major.....	Polaris.....	07 39 11	55 31 34	3
Canes Venatici.....	Canum Venaticorum.....	13 00 00	58 07 56	3
Draco.....	Draco.....	14 10 13	64 28 27	3
Bootes.....	Arcturus.....	14 30 50	19 47 32	3
Corvus Borealis.....	Alpha.....	15 39 44	17 07 38	4
Serpens.....	Serpentis.....	15 58 50	8 47 40	4
Hercules.....	Hercules.....	17 08 38	14 31 30	4
Draco.....	Draco.....	17 08 38	51 30 10	4
Lyra.....	Vega.....	18 36 56	38 40 31	4
Aquila.....	Aquila.....	19 46 35	8 58 37	4
Dolphins.....	Dolphins.....	20 31 13	15 20 50	4
Cygnus.....	Deneb.....	20 37 37	44 01 48	4
Cepheus.....	Cepheus.....	21 15 47	56 5 53	1
Perseus.....	Markab.....	22 38 36	14 34 34	1

LIST OF THE PRINCIPAL STARS IN THE
CONSTELLATIONS ON THE SOUTH
SIDE OF THE EQUATOR.

CONSTELLATIONS.	NAMES OF STARS.	Right Ascension, Jan. 1, 1885.	Declination, Jan. 1, 1885.	Map.
Bridges.....	Achernar.....	01 38 54	34 32 40	6
Orion.....	Rigel.....	05 35 36	8 00 17	6
Lepus.....	Leporis.....	05 37 34	17 04 36	6
Columba Nochi.....	Columba.....	05 38 35	34 3 18	6
Argo.....	Canopus.....	06 31 31	53 37 35	6
Canis Major.....	Sirius.....	06 40 00	16 52 34	6
Hydra.....	Hydra.....	09 21 30	8 9 8	6
Crater.....	Crateris.....	11 38 30	14 8 44	6
Corvus.....	Corvus.....	12 30 30	68 37 1	6
Centaurus.....	Centauri.....	12 36 34	30 34 58	6
Triangulum Australe.....	Trianguli Australis.....	14 31 30	60 31 14	6
Pavo.....	Pavonis.....	16 34 37	56 48 37	6
Grus.....	Grus.....	20 16 35	37 6 20	6
Grus.....	Grus.....	22 0 31	47 31 37	6

ASTRONOMY.

THE HISTORY OF ITS DISCOVERY, AND DESCRIPTION OF THE SCENERY OF THE HEAVENS,

BY

REV. THOMAS MILNER, M. A., F. R. G. S.

CHAPTER I.

ERA OF THE GREEK AND ALEXANDRIAN SCHOOLS.

ASTRONOMY, now the most perfect of all the sciences, is also the most ancient. It separates man in thought from the spot upon which he foot is planted; makes him acquainted with forms and spaces, in comparison with which terrestrial magnitude and distance shrink into insignificance; and unfolds the constitution of the universe, as a scheme involving the intimate connection of the mighty and remote masses that are open to observation,—their incessant activity, unfailling order, and mutual dependence. By its investigations, we gather some faint conception of the immensity in which the Creator centres, to whom alone it is reserved to estimate its length and breadth, its depth and height. Man has learned to distrust and disbelieve the evidence of the most perfect of his senses. He has been taught that the apparently quiescent earth is in perpetual movement; that the real motions of the celestial bodies are, in most cases, in direct antagonism to those which he daily perceives; and that his own world, instead of being the "greatest in the kingdom of heaven," having subordinates under it in the sun, moon, and stars—the long and fondly cherished dream of antiquity—is, in reality, one of the smallest provinces in the great empire of Nature.

Astronomical inquiry goes back to a remote era, and had its origin in the East. The splendor of the celestial phenomena; the fact of periodical changes and of accompanying powerful effects being produced upon the surface of the earth—such as alterations in the temperature of the air, the processes of vegetation, and the habits of animals,—these are circumstances too obvious and striking to have escaped attention, or not to have awakened curiosity. Accordingly, it is only reasonable to consider their thoughtful observation as coeval with the primitive age of man. We may undoubtedly regard the country between the Nile and the Euphrates—the cradle of mankind—as the birth-place of the sciences, and the scene of its first culture.

From the book of Job—in all probability the record of some pastoral chief migrating at an early period on the plains near the Euphrates—we gather indications of the heavenly bodies having attracted the watchful observance of mankind. Though it may be doubtful whether our version rightly renders the *asterisms* named by Arcturus, Orion, and the Pleiades, it is obvious, from the tenor of the passages in which they are introduced, that principal constellations or single stars are intended. The temple of Belus at Babylon, coeval with the foundation of the city, whose ruins are identified with those now extant of Birs Nimrod, is supposed to have been devoted to an astronomical as well as an idolatrous purpose. Its reported construction would seem to intimate this, being of a pyramidal form, with its four faces opposed to the four cardinal points of the horizon. Upon the summit, according to the Greek historian, the Chaldean priests contemplated and exactly noted the risings and settings of the stars.

At the time of the capture of the city by Alexander, his tutor, the philosopher Aristotle, is said by one of his commentators to have received from Callisthenes a catalogue of eclipses observed there during a previous period of 1003 years. Though there may be considerable exaggeration here, yet there is, no doubt, substantial truth in the statement, since Ptolemy gives six Chaldean eclipses, which seem to have been taken from the catalogue, the earliest of which, however, goes no farther back than the year 720 B. C., answering to about the time of the first captivity of the Jews. A comparison of these ancient with modern observations led Halley to the discovery of the doctrine of the moon's acceleration—that is, that she now moves round the earth with greater velocity than formerly, the cause of which Laplace has satisfactorily explained. Ptolemy distinctly refers to Chaldaea as furnishing the best and most numerous astronomical observations; and Cleomedes, speaking of a peculiar eclipse of the moon, states that "no astronomer, whether Chaldean or Egyptian, has ever recorded one of this kind." It is remarkably illustrative of the habit of diligent observation, that the Chaldeans were acquainted with the cycle of 6585½ days, during which the moon makes about 223 synodical revolutions, and experiences the same number of eclipses, alike too in order and magnitude, comparing cycle with cycle. To them is attributed the invention of the zodiac and the duodecimal division of the day.

The honor of priority in observing the celestial sphere has, however, been claimed for the ancient Hindus, the Chinese, and the Egyptians. It may suffice to remark, that the preponderance of evidence is in favor of the plains of Chaldaea being the primal seat of application to observative astronomy—that from thence, as from a general centre, it radiated, at some unknown but remote period, towards the banks of the Nile on the one side, and to India and China on the other—and that, in the infancy of national existence in those countries, the rising and setting of the stars, lunar and solar eclipses, and conjunctions of the planets, were objects of attention, with an entire reference either to astro-

logy, religion, or policy of state. The Hindu tables claim an epoch of 3102 years before Christ, and fix a general conjunction of the sun, moon, and planets, at that era, the beginning of the Caiyug, or iron age of their mythology; but modern calculation proves the impossibility of such a conjunction then occurring—that Venus, in particular, could not have been near it at the time specified. The tables, therefore, are not established on observation, but have been calculated backwards, either from data supplied by native application in a comparatively recent age, or derived from the Greeks and Arabs. With reference to the ancient Chinese, we have little in their annals beyond records of solar eclipses, which were regarded as prognostics of importance to the empire. Those which may be depended upon, as having been actually observed, commence with the year 776 before Christ, and terminate with the year 1433 of our era. But nothing is more dubious than the credit of their native histories; and nothing more certain than the ignorance of the professedly scientific class, even of the simplest operations of practical astronomy, when intercourse was first opened with the people of the West. In Egypt, no doubt, attention to celestial phenomena commenced with the era of its early inhabitants. The exactness with which some of the pyramids have been made to face the four cardinal points has engendered the suspicion that they were designed for an astronomical use. But if the Greek philosopher taught them how to find the height of the pyramids by the shadow, one of the most simple examples of practical geometry, we can form no high idea of the accomplishments of the Egyptians. In fact, Ptolemy, who lived in the country, and may be presumed to have been acquainted with its records, derived none of his materials from that source, but only quotes the observations of the Chaldeans. The sculptured planisphere of the temple of Denderah, supposed to represent the appearance of the heavens at midnight on the summer solstice, about seven centuries prior to the Christian era, is now well known to be a work as recent as the time of the Roman empire. Upon the whole, we have reason to suppose that the astronomy of the ancient oriental nations made no advances beyond that tolerably exact knowledge of the mean motions of the sun and moon which the purposes of agriculture required,—that it chiefly dealt with the simple observation of eclipses, occultations, and the rising and setting of principal stars, which was the work of a priesthood who made it subservient to the consolidation of their superstition,—and that the idea of a cultivated science existing in times of venerable antiquity, the hypothesis of some philosophers half a century ago,—is without foundation.

The present divisions of the sun's apparent path in the heavens, upon each of which imagination has stamped an earthly figure; with the arrangement of the extra-zodiacal signs; date their origin from a remote period, but both era and authors are lost in the mists of ancient time. However inconvenient their use, and undesirable, on other grounds, their retention in the present day, there was a moral grandeur in the idea of registering in the skies the wild legends of mythology, and writing upon the imperishable vault of heaven the customs and events of earth. The grouping of the stars into constellations, to which definite names and figures are attached, had an oriental commencement, though subsequently the Greeks and Romans largely altered and amplified the work of their predecessors. It is not an improbable surmise, that the figures of the zodiac have some relation to the rural occupations of the ancients, or to the phenomena presented by the sun. Thus, the figure of a ram is supposed to have been assigned to the assemblage of stars forming the first constellation, because of the sun being in that part of the heavens at the season when the flocks were taken from the stables to the fields. Thus, also, the lion was chosen to represent the fierceness of the solar heat in summer; the scorpion, to indicate the unhealthiness of autumn; and the balance, to express the equilibrium, or equal length of the days and nights, at the same period. While the Greeks and Romans retained the zodiacal constellations, derived from remoter antiquity, they constituted, as extra-zodiacal, images having a special reference to their own history—the figures of heroes, and the emblems of their deeds, over whose existence hang the clouds of fable, or upon whose reported character rest the blots of shame. It must, however, be acknowledged that the moderns are scarcely in circumstances to blame this proceeding, having contributed themselves to make confusion worse confounded by adding to the motley assemblage of celestial signs. A place in the heavens has been given to the shield of Sobieski, the sceptre of Brandenburg, the crown of Frederick, and the heart of Charles the First.

The age of astronomy in Greece commenced in the seventh century previous to our era; but in the writings of the older poets, Hesiod and Homer, some centuries earlier, allusions occur which show that the appearance of particular stars and groups had been carefully noted. The former mentions the Pleiades remaining invisible for forty days, which has been found to be as accurate as possible for his epoch and latitude.

By THALES—the founder of the Ionic school—the basis was laid, of whatever proficiency the Greeks attained in astronomical science. Of him, the familiar story is related, that when a boy at Miletus, his native city, he fell into a ditch while contemplating the stars, upon which Thressa, his conductress, exclaimed, "Why, O Thales, do you seek to comprehend the things which are in the heavens when you are not able to see those before your eyes?"



The most prominent circumstances concerning him are, that while the Greeks were contented with the rough approximation to the north afforded by the Great Bear, he introduced the knowledge of the little Bear, by which the Phœnician mariners had long been accustomed to steer; that he made a near approach to the diameter of the sun, taken at a mean; taught the sphericity of the earth; and predicted a great solar eclipse, which occurred at the time announced. We may regard this last-mentioned particular as the greatest astronomical achievement, resting upon good authority, that had hitherto transpired. Herodotus observes, that in the midst of an action between the Medes and Lydians, the day was suddenly changed into night. He adds, that Thales the Milesian, had predicted the year in which the eclipse would happen, and that the hostile armies, when they saw the darkness, desisted from the battle. The late Mr. Bailey considered the year in question to be 610 B.C., but after a careful investigation in 1857, using improved lunar tables, the present Astronomer Royal, Sir G. B. Airy, decided in favor of May 28, 585 B.C. as the exact date. Such a prediction could only have been made with certainty by one in possession of a long series of observations derived from some foreign source, as the Greeks themselves had not originated any; in all likelihood from Chaldaea, where the requisite materials might be found.

The opinions held by the successors of Thales are in several respects remarkably accordant with modern ideas. Anaximander maintained the tenet of the earth's movement about its axis, and of the moon's light being reflected from the sun. Anaxagoras, who transferred the Ionic school from Miletus to Athens, in addition, offered a conjecture that, like the earth, the moon had habitations, hills, and valleys. These doctrines were taught upon a more extended scale by PYTHAGORAS, who appears to have reached the sublime conception of the earth's motion round the sun, which Philolaus, his successor in the Crotonian school, is generally believed to have taught openly. According to the Pythagoreans, not only the planets, but the comets themselves, are in motion round the sun, and not floating meteors formed in the atmosphere. But these were the conjectures merely of sagacious minds, not possessed of the evidence requisite to give prevalence and stability to opinions, while they were directly opposed to the testimony of the senses. Hence, instead of obtaining the suffrages of antiquity, they met with little acceptance; and for eighteen centuries, the apparent motions of the heavenly bodies were regarded as unfolding the true constitution of the universe. A blind submission was yielded for ages to the dogmas of the Aristotelians, who held the earth to be the quiescent centre of the universe, the celestial bodies its servants, moving in circular orbits, and with uniform velocities, and comets simply meteors generated in the terrestrial atmosphere. The "divine" Plato indeed, the master of Aristotle, is said to have renounced his opinion upon one of these points in his old age, and to have admitted that the centre ought to be appropriated to some more noble object than the earth, or rather, than terrestrial substance. It is a plausible conjecture, that the elements of his own system were first suggested to the mind of Copernicus by notices



of the opinions of the disciples of Thales and Pythagoras. They won few converts, however, among the Greeks, and in some instances exposed their professors to persecution.

Egypt became the chief seat of astronomical science in the ancient world soon after the age of Aristotle. Alexandria had risen by the delta of the Nile at the command of the conqueror from whom its name is derived, and under the superintendence of the architect who proposed cutting Mount Athos into the

figure of a man. Upon the death of Alexander it became the capital of one of the kingdoms formed out of the ruins of his empire. The first of the Ptolemies laid the foundation of its celebrated library—perhaps the most extensive collection of books ever brought together before the invention of printing. His successor established in connection with it a college for the cultivation of the pure sciences, invited the most accomplished of the Greeks to repair to it, supplied them with whatever instruments could be furnished necessary to their pursuits and thus arose the Alexandrian school, which received the flattering epithet of Divine, on account of the acquirements of its professors, and the philosophical character of its investigations. It originated a connected series of observations relative to the constitution of the universe. The positions of the fixed stars were determined, the paths of the planets carefully traced, and the solar and lunar inequalities more accurately ascertained. Angular distances were calculated with instruments suitable to the purpose by trigonometrical methods, and, ultimately, the school of Alexandria presented to the world the first system of theoretical astronomy that had ever comprehended an entire plan of the celestial motions. The system we know to be false, and inferior to the Pythagorean notions; but it had the merit of being founded upon a long and patient observation of phenomena, a principle which finally brought about its own destruction, while the previous theories were the results of pure hypothesis.

The most interesting circumstances connected with the early history of the Alexandrian school are the attempts made to determine the distance of the earth from the sun, and the magnitude of the terrestrial globe. Aristarchus of Samos is the author of an ingenious plan to ascertain the former. Suppose the centre of the circle s to represent the centre of the sun, m that of the moon, e being the position of an observer on the surface of the earth. It is easy to perceive that, when the moon has half her disc illuminated by the sun, a line drawn from e to m will be perpendicular to another line drawn from s to m , making with each other a right angle. The plan of Aristarchus was, that the angular distance $s e m$ should at that time be taken, which is possible, because both the sun and moon may then be seen at once above the horizon, from whence the ratio of $s e$ to $e m$ may be determined. He obtained the general result, that the distance of the sun from the earth is about nineteen times as great as that of the moon from the earth. We now know that the distance is much greater; but notwithstanding the inaccuracy of the result, the method employed is undoubtedly just, and reflects the highest honor upon the genius of its proposer. The determination of the sun's distance from the earth, with anything like precision, is only of recent date, and has been effected by means of which the ancients could have had no conception. Aristarchus held the Pythagorean doctrine of the motion of the earth in space, and gave the right answer to the formidable objection long afterwards made to it, that of the non-existence of an annual parallax. The answer recognized the earth's orbit as being an insensible point in comparison with the vast distance of the fixed stars. The boundaries of the universe were thus extended to his mind far beyond any limits conceived by his predecessors.

The attempt to determine the magnitude of the earth was made by Eratosthenes, and we have reason to believe this was the first attempt ever made to solve the problem, as certainly it was to do it upon a true principle. Syene, in Upper Egypt, was supposed to lie exactly under the tropic of Cancer, as it had been observed that, on the day of the summer solstice, at noon, a well there was enlightened to the bottom, while vertical bodies threw no shadow for the space of about three hundred stadia around it. At Alexandria, therefore, which was conceived to lie under the same meridian, on the same day at noon, when the sun was believed to be vertical at Syene, Eratosthenes measured his zenith distance, or the value of an arc of the meridian between the two cities. Let e be the centre of the earth, A Alexandria, s the sun, and S Syene. The celestial arc contained between the zeniths of the two places, Alexandria and Syene, was found to be equal to 1-50th of the circumference of a circle, that is, to $7^{\circ} 12'$. Now, admitting the earth to be of a spherical form, Eratosthenes would obtain the measure of its circumference, by multiplying fifty times the distance between the cities. This distance was ascertained by order of the government to be 5,000 stadia, and consequently the result obtained for the length of the whole terrestrial circumference was 250,000 stadia. The great uncertainty that exists, as to the value of the stadium in question, prohibits any appreciation of the measurement; but several important errors were committed in the practical application of a right principle. No allowance was made for the solar parallax, and instead of Syene being under the tropic of Cancer and on the meridian of Alexandria, it is about 50° north of the former, and nearly 8° east of the latter. The principle of the method employed is, however, precisely the same as that which has been acted upon in modern times; and our more accurate results in determining the magnitude of the earth are owing to greater nicety in observation, attention to all the elements which the solution of the problem requires, and more perfect instruments for the measurement of linear and angular distances.

We now come to the greatest astronomical name in antiquity—that of Hipparchus—who may be properly regarded as the father and founder of real astronomy. The invention of spherical trigonometry is supposed to be due to him. He approximated also closely to the true length of the tropical year, which had been previously held to be 365 $\frac{1}{4}$ days. This he discovered to be an error in excess, by comparing one of his own observations of the summer solstice, with another made by Aristarchus of Samos, 145 years before. His own determination of 366 days, 5 hours, 55 minutes, 12 seconds, exhibits a value greater than the truth by $6^{\circ} 18'$ only, as according to Laplace, the length of the tropical year at that time must have been about $4^{\circ} 3'$ shorter than in the present

age. The appearance of a new star in the time of Hipparchus is said to have induced him to make a catalogue of the fixed stars, in order that posterity might be able to recognize any changes that might take place in the appearance of the heavens; and in executing the task he rendered essential service to astronomy, and made his most remarkable discovery. Comparing the place of the star *Spica Virginis*, as determined by himself, with that assigned to it about 170 years previously by two distinguished Alexandrians, he found that this star was six degrees distant from the autumnal equinox, whereas the before-mentioned astronomers had found it eight degrees from the equinox. He saw that there must have been either a movement of the star in longitude during the interval, or a contrary movement of the equinoctial point in the heavens. The same phenomenon was observed in relation to other stars; that while their latitudes had been retained unaltered, they had advanced in longitude; and hence the retrogradation of the equinoctial points along the ecliptic was inferred, the cause of which remained a secret till the age of Newton.

The catalogue formed by Hipparchus contained 1080 stars. After determining the places of the stars, Hipparchus made a representation of the heavens on the surface of an artificial globe, which appears to have been deposited at Alexandria; and with him also the happy idea originated of marking the positions of towns in the same manner, by circles drawn parallel to the equator,

and lines perpendicular to it, or by latitudes and longitudes. After him, there is little to invite attention in the history of astronomy for nearly three centuries, when we come to Ptolemy, the first who formally branched a system of the universe which has been handed down to us.

Ptolemy was the best scholar of his age—a practical astronomer, mathematician and geographer—the author of the important discovery of the evection or libration of the moon. Born in Egypt, and flourishing at Alexandria through the reigns of the emperors Adrian and Antonin, he there became acquainted with the writings and observations of Hipparchus. He recorded

the advances of past ages in astronomy, the state of the science in his own time and developed a plan of the celestial movements. It recognized the earth to be a spherical body—to be the immovable centre of the universe—the sun, moon, planets, and fixed stars, prosecuting a daily revolution around it, in perfect circles, and with uniform velocities. These were dogmas firmly held by the Platonists and Aristotelians, who stoutly clung also to the idea of circular orbits and uniform velocities in relation to the celestial luminaries.

We have seen, however, that the Greeks had a cultivated acquaintance with other movements besides the apparent diurnal revolution of the sphere, movements in an opposite direction to it. They had carefully traced the sun's path in the ecliptic, that of the moon in her orbit, and they had marked likewise the striking peculiarities of planetary motion. To an observer on the earth, the planets appear to pursue a course of the most irregular and unsystematic kind, which was a perfect puzzle to the ancient theorists. Sometimes they seem to go along

with the sphere, but with greater celerity; then, to remain stationary; then, to retrograde, or describe a circuit like a loop in a knot of ribbons. The paths of Mars and Jupiter, as observed from the earth, described the courses roughly represented in the diagram, at the intervals stated. Hipparchus was too well aware of the imperfection of observation, and of the importance of supplying data upon which to found a theory, to be given to theorising himself. But when he did systematise, he departed from one of the cardinal maxims of his compeers and successors, by supposing the sun to revolve round the earth in a circle, the earth not being at the centre. He had found the interval between the vernal equinox and the summer solstice 94½ days, and that from the summer solstice to the autumnal equinox

only 92½ days, thus making the length of the summer half year 187 days, and that of the winter half year 178 days. To account for this unequal division of the year, and to reconcile it with the idea of the sun's orbit being a circle and his velocity uniform, Hipparchus dismissed the hypothesis of the central position of the earth. He supposed an eccentric circle, according to which, A B C D may represent the solar orbit, E the place of the earth, not coincident with F the centre of the orbit. E F will be the eccentricity, O H the line of the apses; I the position of the sun at the summer, and J at the winter solstice, K his place at the vernal and L at the autumnal equinox.

This theory provides for the circular orbit and uniform velocity of the sun; for the unequal division of the year, and an apparently unequal rate of motion to a spectator at the earth; for the two arcs formed between K and L are unequal, and it is perfectly obvious that if perceptible to a terrestrial observer the sun would appear to travel fastest at the nearest point of the apsis, I, and slowest at the furthest, O. This scheme is chiefly remarkable for its removal of the earth from the post of honor in relation to the solar orb.

The idea of his great predecessor was not admitted by Ptolemy, who contented for the immobility and central situation of the earth, and attempted to reconcile with these positions, and with the dogmas of perfect circles and uniform velocities, the diverse and complex movements in the heavens. His theory of epicycles combines two movements in the heavens, that of a centre and a circumference. Thus let E be the earth, and M an imaginary centre in the heavens: the planet is supposed to be moving around it in the circumference a b c d all the while the imaginary centre is accomplishing the orbit A B C D. A little attention will soon discover that upon this hypothesis the planet's motion will appear at times direct, stationary, and retrograde to an observer on the earth.

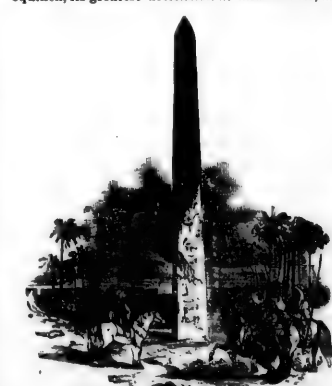
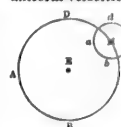
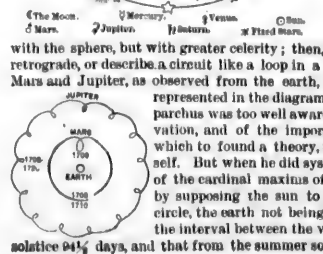
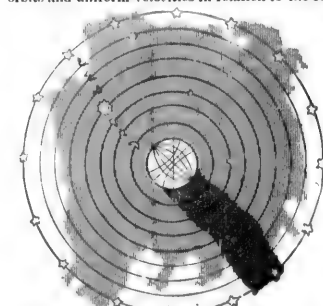
The later Ptolemaists occupied themselves for centuries in amplifying and mending his system, supplying an epicycle here where it was wanted, and an eccentric there when required, and even converting his imaginary spheres into solid transparent wheels, revolving the one within the other, and each carrying a planet attached to it.

A scheme nearer to the truth than the Ptolemaic, commonly called the Egyptian, was in vogue when the former was brouched. It regarded the inferior planets as revolving round the sun, and moving in conjunction with the sun, round the earth. It is obscurely hinted at by Pliny; but explicitly announced by Vitruvius, who lived a short time prior to Ptolemy. Mercury and Venus, the architect remarks, are the planets nearest to the rays of the sun, and move round the latter as a centre, appearing sometimes progressive, sometimes retrograde, and occasionally stationary among the signs.

The instruments of observation known to the ancient world were of a simple and imperfect kind. The earliest of which we read is a vertical pillar employed to determine the sun's altitude by means of its shadow. It was in general use for this purpose among the Oriental nations. The lofty pyramidal stone which Diodorus Siculus describes as hewn out of the mountains of Armenia by order of Semiramis, and set up in a conspicuous part of the city of Babylon, is conjectured to have been erected with this design. A Chinese record of uncertain date, but undoubted antiquity, refers to an observation on the length of the meridional shadows cast at the times of the summer and winter solstices by means of a vertical pillar. It is scarcely to be doubted that such a simple and obvious way of approximating to the length of the year must have suggested itself at a very remote period. The greatest elongation of the shadow cast by the pillar at noon at mid-winter, its gradual decrease towards the vernal equinox, its greatest declension at midsummer, and its gradual advance to its maximum elongation again, are points to which we may believe attention was early directed; and a series of observations, taken with precaution, would lead to some results valuable in a rude state of society, and to an agricultural people.

Augustus removed two grand obelisks from Egypt to Rome expressly to be used as gnomons, which conveys the impression that they had previously served that office; and Manlius placed a tall upon the obelisk erected by him in the Campus Martius, with a view to facilitate the accurate delineation of its shadow. The great importance in astronomy of precisely ascertaining the hour of any phenomenon occurring, or observation being made, led to various forms of the sundial, and to the construction of instruments for measuring time by night and by day when the sun was obscured.

A great variety of instruments were constructed by the Alexandrians



Obelisk at Heliopolis.

Astronomical, or armillary spheres, were used in the observation of solar and sidereal phenomena. These, in the hands of the Arabs, at a subsequent period, were largely improved, and made upon a gigantic scale. Whether any knowledge was possessed of the means by which the natural sight is now assisted in the contemplation of distant objects, is a controverted topic. From some obscure intimations found in the ancient writers of bodies circulating in the universe invisible to the naked eye, it has been conceived that the satellites of Jupiter and Saturn are meant, having been discovered by the aid of instruments analogous to the telescope. Sir W. Drummond assigns a knowledge of that instrument to the Greeks, Chaldeans, and Hindus; but though some strong facts may be quoted in favor of the former, the evidence is not sufficient to warrant the inference. In enabling the eye to bear the brilliancy of the solar light, when directed towards that luminary, various methods were adopted. Aristotle speaks of mirrors being used in his time, probably meaning the metallic plates finely polished. Ptolemy mentions vessels of oil being employed in viewing eclipses, and Seneca refers to the medium now common, that of smoked glass.



ERA OF COPERNICUS, TYCHO BRAHE, KEPLER, AND GALILEO.

The interval between the overthrow of ancient civilization by the rude and warlike tribes that took possession of its seat, and the revival of learning, exhibits an entire neglect of the liberal arts, with the exception of the Arabs during the era of their power on the banks of the Tigris in the East, and the Guadalquivir in the West.

Arabian cultivation commenced with the dynasty of the Abbassides, or the middle of the eighth century, when a taste for astronomical science had been created among the followers of the prophet. The work of Ptolemy was their text-book; his system, theirs; but instruments were constructed upon a larger scale; his determinations were subjected to a rigid examination; and in many instances a more accurate conclusion was obtained. The length of the tropical year was found within a few seconds of the truth. A degree of the terrestrial meridian was measured in the Desert near Palmyra, to verify the value obtained by Eratosthenes. The obliquity of the ecliptic was determined. The great inequalities also of Jupiter and Saturn are marked in the tables of planetary motions constructed by the Arab astronomers. Their observations, in general, of the celestial bodies have a greater degree of accuracy than those of the Greeks, on account of the necessary correction being made for the phenomena of refraction, which was observed with reference to bodies near the horizon. Bagdad, however, was only the centre of a movement in favor of science. The impulse extended as wide as the language and profession of Islam, to Egypt, Morocco, and Spain. An observatory was erected in the northern part of Persia, by a descendant of Gengis-Khan; and Ulugh-Beg, a prince of the house of Timour, erected one at Samarcand, where he compiled his now extant catalogue of the stars.

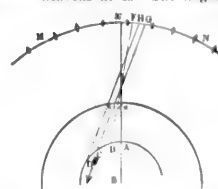
NICHOLAS COPERNICUS, or ZEPERNIC, was born at Thorn, some time in the years 1472 or 1473. He was educated with an eye to his father's profession of medicine, but was diverted from it by hearing a course of lectures which inspired him with a passion for astronomy. He was at Bologna, in Italy, in 1497, studying the science under Dominic Maria, and settled for a time at Rome as a teacher of mathematics, where he established a considerable reputation. His uncle, who was bishop of Ermland, upon a vacancy occurring in the canonry of his cathedral church of Frauenburg, appointed Copernicus to the place. Here he passed the remainder of his days, dividing his time between his ecclesiastical duties, the gratuitous practice of medicine among the poor, and astronomical researches. His mind was profoundly impressed with the idea that simplicity characterizes the arrangements of nature; and, struck with the want of this in received hypotheses, he seems to have come to the conclusion that such scenes of complexity could not be true representations of the heavens. It does not appear when his own views became settled; but in the year 1530, the manuscript of his work "On the Revolutions of the Heavenly Bodies," was finished. In this production he disclosed his system; the Earth, a planet revolving round the Sun in an orbit between Venus and Mars; its rotation upon its axis producing the apparent diurnal procession of the heavens; the complicated movements of the planets being the consequence of their own motions in space, combined with that of the Earth.

The prudence of the great discoverer in propounding his views is no less admirable than his sagacity in seizing hold of them. He communicated privately with his friends; Reinhold and Rheticus, astronomers; Schönerberg, a

cardinal; and Giese, a bishop. With these parties his views found acceptance. His work, completed in 1530, was still in manuscript in 1540, notwithstanding repeated efforts to induce him to publish it. An arrangement at length was made, during the latter year, for Rheticus to furnish an account of the manuscript volume; and, that being favorably received, Copernicus consented to the appearance of his own production. The illustrious author did not live to read his work in print. A copy was handed to him as he lay, a paralytic, upon his bed. He saw it, he touched it, and in a few hours afterward expired, May 24, 1543.

The scheme of Copernicus was presented to the world in the form of hypotheses. "Astronomers," he remarks, "being permitted to imagine circles to explain the motions of the stars, I thought myself equally entitled to examine if the supposition of the motion of the earth would render the theory of these appearances more exact and simple." Proceeding upon the assumption, which was universally admitted, that the earth is a mere point when compared with the distance of the fixed stars, he very naturally remarked upon the improbability of such a vast circumference revolving in twenty-four hours, instead of the infinitesimal point by which the whole phenomena would be equally as well explained.

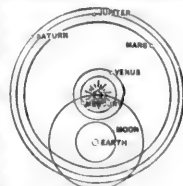
The other conditions of the problem of the celestial motions the sun's path in the ecliptic, are as exactly answered by the supposition of the earth's orbital motion. The annual revolution of the earth round the sun causes the apparent annual revolution of the sun round the earth; and when we consider the vast magnitude of the solar orb, and the enormous waste of force implied in moving the greater body around the less, when precisely the same effects are producible by moving the less about the greater, our common sense is at once enlisted in favor of the latter hypothesis as Nature's "wise and frugal" plan. The apparent eccentricities of the planets likewise, their direct and retrograde movements, that mysterious puzzle which called the epicycles of the Ptolemaists into existence, are explained upon their own principle of two combined motions: an observer on the earth in ceaseless translation sees them performing a similar orbital course, and apparent irregularity and involution are the consequences of the combined prosecution of direct and regular paths. Suppose the sun, A , B , C , D part of the earth's orbit in the direction of the arrow, a , b , c , d part of the orbit of a superior planet, and m , n an arc of the celestial sphere. When the earth is at A , and the planet at a , a terrestrial spectator will see it projected to a place in the heavens at x . The angular motion of a superior planet being less



rapid than that of an inferior, when the earth is at n the planet may be supposed to be at d , and its place will be projected in the heavens at r , thus apparently retrograding in the sphere from x to r , while accomplishing the direct movement from a to d . The next movement of the earth, s , c , and of the planet, d , c , will produce a further retrogradation of the latter in the heavens from r to o ; but, when the earth has arrived at b , and the planet at b , the retrocession of the planet will appear to have ceased, and the direct movement, o , n , to have taken place. As both the earth and the planet proceed in their orbits, the planet will appear stationary among the fixed stars, then to pursue a direct course, and afterwards to retrograde again.

The sixteenth century was distinguished at its close by the labors of TYCHO BRAHE, a Dane, born at Knudsthorp, near the Baltic, three years after Copernicus terminated his career. His attention was called to astronomy by a great eclipse of the sun, August 21, 1560, when quite a child. The fame of Tycho has been obscured by his rejection of the Copernican doctrine, and the construction of a system of his own, combining the elements of the Ptolemaic and Copernican theories. He maintained the earth to be the immovable centre of the universe, but supposed the planets to revolve round the sun, and to be carried with their centre in revolution round the earth.

The adoption of this hypothesis has been usually deemed discreditable to Tycho; but it will be only fair to recollect that the Copernican theory was, in his day, quite incapable of proof. He argued, against the diurnal motion of the earth, that, upon that assumption, a stone dropped from the summit of a high tower would not fall at the base, as we see it does, because the velocity of rotation would carry the tower several hundred feet during the descent of the stone, which would, therefore, fall at that distance behind it. This argument was employed by Ptolemy, who stated that, if the earth revolved with great rapidity from west to east, it would leave behind it the clouds, birds flying in the air and, generally, all objects suspended in the atmosphere. The answer to this is, that a falling body will partake of a rectilinear and circular motion; the former tending to the centre of gravity, the latter proceeding in the direction of the circumference described by the point from which it falls. Galvani tried experiments in the harbour of Marseilles, and proved, what every one now knows, that a stone dropped from the mast of a vessel in full sail will partake of the advance of the mast, and fall at its foot, as though the vessel were at rest. Let the circle x be the equatorial circumference of the earth, the line z a tower perpendicular to o the centre, and the circle m will then be the circumference described by the summit of the tower s , in the course of one rotation of the earth upon its axis. If we suppose the base of the tower,



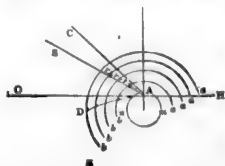
b, to pass to c, the summit, s, will, in the same time, pass to A, and, this being the larger arc, it follows that the summit must travel faster than the base. Assuming, then, the earth's rotation eastward, a stone dropped from the summit will leave it with its momentum, and will move faster eastward, through the whole of its descent, than the base. The result will be, that it will deviate from the plum-line, and reach the ground a little to the east of c, the foot of the perpendicular. Newton first threw out the idea, and calculated that a ball won't deviate about half an inch from the plum-line, to the east, from the height of three hundred feet. Thirty balls descended from the height of two hundred and thirty-five feet, in St. Michael's tower, Hamburg, and deviated from the perpendicular four lines eastward, swerving also one line and a half southward, owing probably to a current of air in the tower. The experiment was, therefore, repeated in a coal-pit, in the county of Mark, two hundred and sixty feet deep. There the balls fell five lines eastward of the perpendicular, but neither northward or southward, so that the theory of the earth's motion on its axis may now be said to have received a complete and sensible confirmation.



The reason which led Tycho to reject the doctrine of the earth's orbital motion was of great force in his time. Knowing that if the earth moved, its change of place from one extremity of the diameter of its orbit to another produced no sensible alteration in the place of the stars, so that they must be at an enormous distance, and yet seeing then, present a diameter to the eye varying from a quarter to as much as two minutes, had little option but to assign a magnitude utterly inconceivable to the nearest fixed star, or reject the theory of the earth's motion in space. He chose the latter alternative; and though undoubtedly it would have been a wiser course to have paused before coming to such a conclusion, which the Copernican system as then developed might well have justified when viewed as a whole, we are not warranted in interpreting his rejection of it much to his disparagement.

The career of Tycho is far more satisfactory as a practical astronomer than as a theorist. In the year 1572, the remarkable event of a stellar apparition attracted the attention of Europe, and excited universal speculation. It was early in November, when Tycho observed a star of great splendor in the constellation Cassiopeia, which he had never seen before, as he was walking across the fields about ten o'clock in the evening. It beamed with a lustre quite unwonted in that part of the heavens. It could not have escaped his observation had it previously been there. He suspected at first an optical illusion, but found a group of peasants gazing upon it with as much astonishment as himself. Its place he at once fixed by his instruments, and noted the fact with all its circumstances in his journal. The same star was observed by Cornelius Gemma, who had particularly examined that part of the heavens two nights previous, and was confident of its not being present then. It continued visible for the space of sixteen months, gradually diminishing in lustre, until it finally vanished in March, 1574. The brilliancy of this star was so great as at first to cause Tycho's staff to deflect a shadow. Its light changed from white when the brightest to a yellowish hue, and afterwards had a fiery tinge like Mars, becoming livid like Saturn before its disappearance. The appearance of a new star had been observed in Europe about three centuries previous, and such occurrences are mentioned by the ancients; but this taking place in a comparatively enlightened age naturally excited serious observation and inquiry.

The labors of Tycho were also directed towards forming a catalogue of the stars, and he determined the relative and absolute positions of 777, a work inferior as to numbers to preceding catalogues, but vastly superior on account of its scrupulous exactness. To him, also, we owe the discovery of that inequality of the moon called the variation, that of the inequalities of the motion of the nodes, and of the inclination of the lunar orbit; and by a comparison of his own observations with previous ones, he was the first to announce the slow diminution of the obliquity of the ecliptic, which the theory of universal gravitation now teaches. In practical astronomy the refraction of the atmosphere is an important element, for, owing to it, all the heavenly bodies appear to us considerably higher than they really are. Let $a, b, c, d, e, f, g, h, i, k, l, m, n$, be strata, or layers of the atmosphere, increasing in density towards m, n , the surface of the earth. A ray of light from the star s , impinging on the atmosphere, will be refracted, or bent, so as to move in the curve $rsaa$; and as an object is seen in the direction of the ray that meets the eye, the star which is actually at s , will seem, to a spectator at A , to be in the direction c . This refraction, which always acts in a



vertical direction, elevates objects above their real place, and hence a body at s , below the horizon, if a , will be raised and seen as if at c . Ptolemy, as has been already noticed, was acquainted with the refraction of the atmosphere, and mentions it in a treatise on optics, but as it is not alluded to in his astronomical work, it is presumed that he had not then discovered it, and made no practical use of it in observation. The Arab astronomers, likewise, were aware of the fact through him, but to Tycho Brahe the honor belongs of calculating its effects, correcting altitudes by them, and forming the first table of refractions. He estimated its amount at $34'$ with reference to bodies in the horizon, which is nearly correct.

The urgent recommendation of Tycho to his own sovereign by the Landgrave William, induced the King of Denmark to offer him an asylum in his own country, and an annual provision for the prosecution of his scientific pursuits. From the King of Denmark, Tycho received a grant of the small island of Høene in the Baltic, opposite Landskrona, and an annual allowance of two thousand dollars, with the proceeds of a fief in Norway, and a canonry in the church. Here he laid the foundation of a house and an observatory, which ultimately grew into a fantastic castle, resembling rather the abode of an eastern magician than the home of a sober astronomer. Uraniberg, or the castle of the heavens, expressed the large views, feudal spirit, and undisciplined mind of its architect and tenant. Its front elevation, shown in the vignette, extended sixty feet in length, and seventy five in height. It was surrounded by a wall twenty-two feet high, in the form of a square, each side of which was three hundred feet, and had in the middle stately gateways, with residences for servants. The instruments of the observatory were upon a corresponding



scale. A celestial globe, upon which Tycho fixed the positions of the stars he catalogued, stood upon a pedestal five feet high, the diameter of the ball being no less than six. His whole apparatus is as posed to have cost upwards of two hundred thousand crowns. Misfortune, however, came soon after the death of his royal patron. He finally quitted his country, but Uraniberg had obtained a firm hold upon his affections, and separation from it took away the charm from life. After various wanderings, he settled at Prague under the patronage of the Emperor Rudolph. There he died in the first year of the seventeenth century, leaving a name second to none in point of pure observation.

However bitter and disastrous to himself the exile of Tycho from his northern home, it was fortunate for science that it took place, as it threw into his way the indefatigable Kepler, the very man in his maturity to seize hold of his materials, and draw a philosophical deduction from them. The Danish astronomer, who had previously seen one of his works, invited him to become his assistant at Prague. He appreciated his genius, hospitably supplied the wants of his poverty, taught him the habit of rigid investigation, and left him the legacy of his own observations at his decease. JOHN KEPLER, born at Wül, in the duchy of Wurtemberg, in 1571, was educated for the church, but withdrew from the science of theology to that of mathematics and astronomy, and occupied the chair of the latter at Gratz in 1594. His first reward was the discovery of the elliptical orbits of the planets. The Copernican system had respected the ancient reverence for the circle as the only path proper for celestial bodies to describe. An opposition of Mars, whose path is one of the most eccentric in the planetary system, led Kepler to study his motions, and among the papers of Tycho, then deceased, he found a large number of observations upon this and the other planets. He began his researches with his mind fully possessed with the idea of circular motion, but he found it utterly impossible by any conceivable arrangement of cycle and epicycle, to represent the known motions of Mars. The discovery came at length that the planet's path was an ellipse, the sun occupying one of the foci, the two points around which the oval is formed, instead of being in the centre.

His next discovery was no less remarkable. While the scheme of Copernicus retained the ancient idea of the heavenly bodies describing circles, it held also the notion of their velocities being uniform. But the mass of facts accumulated by Tycho proved that the motions of Mars were not uniform—that the planets move with different velocities in different parts of their orbits; and the inquiring mind of Kepler directed itself to ascertain the rule which regu-

ASTRONOMY.—ITS EARLY DISCOVERIES

lated their rate of motion—a bold attempt, but crowned with complete success. Let the ellipse represent the orbit of a planet, and s the sun in one of the foci. A straight line drawn from the planet at a to the focus, called the radius vector, and another line drawn from the planet at b , bound a certain extent of area, and the planet periodically passes from a to b in a certain amount of time proportioned to the area. For the sake of illustration, the time may be rated at a month. If we now draw straight lines from the planet at c, d, e, f , and g , other areas will be bounded, which we may suppose equal to the former, and to each other. The planet will then pass from a to b , from b to c , from c to d , and so on, in equal times



or in a month. But, obviously, while the areas described by the radius vector are equal, the actual orbital path of the planet is unequal, and it must travel with greater velocity from a to b , than through the other parts of its course. His third discovery refers to the distances of the planets from the sun. His mathematical mind caught the idea that these bodies must bear some mysterious relation to each other, and after a long and harassing pilgrimage in search of a clue to their affinity, he groped his way to the perception of a physical fact, which unfolded before him the unity of the solar system. This was the discovery, that the squares of the periodic times of any two planets are to one another as the cubes of their distances from the sun. His joy was unbounded at this discovery, as it transpired in an unexpected manner, and it may be ranked among the most important and glorious physical truths ever reached by the intelligence of mankind. Popularly expressed, the fact arrived at is, that the distances of two planets from the sun being known, and the period or year of one of them, the period of the other may be ascertained by the above simple proportion; and clearly does this fact involve the idea of the bodies to which it applies not being thrown at random into their places—not being independent—but members of one great system. As an example, Mars is about four times the distance of Mercury from the sun; his period of revolution is about eight times that of the latter; and the cube of four, or sixty-four, is equal to the square of eight. Such are the laws of Kepler. They obviously confirm while they correct Copernicus; and their author became a zealous Copernican.

The phenomenon of a new star was again presented to the gaze of mankind in the year 1604, thirty-two years after the former appearance. Kepler was one of its observers, and adopted the hypothesis that it proceeded from some vast combustion. But what these stellar apparitions really are, examples of which have met the eye of the present generation, we do not yet certainly know. In 1607 the comet, afterwards known as Halley's, engaged the attention of Kepler, and again in 1618 he had the opportunity of observing a similar object. He attempted to determine the path of Halley's on the supposition of its motion being rectilinear, conceiving comets to be evanescent bodies, appearing and vanishing for ever.

The early part of the seventh century was distinguished by the construction of an instrument which rendered objects accessible to human vision in the remotest depths of space, and which speedily added important accessions to the knowledge previously acquired of the visible heavens. A journey to Venice on the part of Galileo in the year 1609, the accidental mention of a fact in a conversation there led to the construction of the telescope, to the accurate survey of the heavens by it, and to the confirmation of those views of the universe which the retired ecclesiastic of Frauenburg had the sagacity to conceive and the boldness to adopt. He directed his inventive powers to the construction of such an instrument for himself, and ultimately succeeded in perfecting a telescope which, in his own words, could "show things almost a thousand times larger, and above thirty times nearer, to the naked eye." On examining the moon, he at once discovered its analogy with the earth, and detected the fallacy of the Aristotelian physics, which regarded all the celestial bodies as perfectly round, self-luminous, and without any terrestrial tarnish. The lunar surface exhibited plains and mountain ranges, highlands and glens, with the diversity of dark shadows and vivid illumination, which the face of our own globe displays as seen from some towering peak, or from the car of the aeronaut. But a richer harvest awaited him on turning his attention to the planets. Gazing at Jupiter on the night of January 7, 1610—a memorable night—he saw three small bright stars eastward of the planet, and close to its disk. Subsequent observations revealed a fourth, and ultimately disclosed the fact that Jupiter was, before him with a retinue of four satellites, which he named the Medicean stars, from his patrons the Medici. This was a death-blow to that dream of pride which the followers of Aristotle had been indulging for ages; and one of the chief objections advanced by them to the Copernican doctrine was now demolished. The earth, as their vain philosophy had taught, could no longer be regarded as the most dignified body in the universe, having an attendant moon, and, on that ground, entitled to be the centre; and equally, she must resign her right to be at rest, for here was a more dignified body in motion.

Another fact which the application of the telescope brought to light, illustrating the truth of the Copernican system, was the solar spots, their incessant motion, and the consequent rotation of the great luminary. The metaphysics of the schoolmen had taught the quiescence of the earth on account of its ponderous mass, but the position was destroyed at once by the sun, a far mightier body, being discovered to have a revolution upon his axis.

Before the death of Galileo the telescope had been adapted to instruments for measuring angular distances. Practical astronomy also received one of its most beautiful and important acquisitions soon after the telescope, in the application of the pendulum to clocks, affording a more exact method of measuring time. This was followed by the invention of the transit instrument, used in determining declination and right ascension, or the distances of the stars and any celestial phenomenon from certain fixed points in the heavens. The for-

mer was the work of Huygens, a Hollander, the latter of Roemer, a Dane. But the "optic glass" of the "Tuscan artist" is the chief glory of the seventeenth century among mechanical constructions—as the germ of those mighty tubes which, at Greenwich, Dorpat, and Washington, now search the profundities of space—utterly insignificant, indeed, when compared with them, as much as the seedling to the tree which a thousand years has braved the breeze, yet still the germ! A cylinder of lead, a few inches long, with two spectacle-glasses at its extremities, one convex, and the other concave—the plaything of a child—was the original telescope; yet, even in the day of its feebleness, it was sufficiently strong to break down the barrier which had arrested the knowledge of all antiquity, and manifested to the gaze of man what had successfully defied his glance for ages—the lunar steeps, highlands, and ravines—Venus in phase—Jupiter surrounded with his servitors—and Saturn's strange and then inexplicable structure.

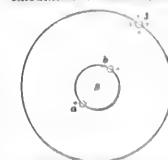


ERA OF NEWTON, HALLEY, AND HERSCHEL.

There is no great operation of which we are cognizant, by which Nature at a single bound perfects her marvellous productions. The ultimate result is reached by a progressive advance. The cedar, on whose boughs the snow rests, and the fowls nestle, is the work of centuries; and the soil that laps its roots, the air that stirs its branches, the light that plays upon its crest, and the rain that drops upon its foliage, minister to the final development of the original cone.

We have seen four of the European nations represented in the advance of astronomical science—Poland by Copernicus, Denmark by Tycho, Germany by Kepler, and Italy by Galileo. The procession had been joined by Holland, France and England, before the middle of the seventeenth century. To Hevelius, one of the merchant princes of Danzig, we owe the first accurate delineation of the lunar surface; and the discovery of a libration in longitude. By observation of the comet of 1664, he further corroborated the view previously taken, that such bodies are not subliminary, and approximated to the nature of their orbits. His contemporary Huygens, after effecting various improvements in the telescope, discovered one of the satellites of Saturn, the largest and best known, or Titan; and obtained an insight into the singular structure of the planet, an inexplicable appearance to all preceding observers. Cassini, nurtured in France, soon afterwards added four more satellites to the system of Saturn, those now called Tethys, Dion, Rhea, and Japetus, and he detected the black list, or dark elliptical line bisecting the surface of the ring, and dividing it into two.

Roemer, the inventor of the transit instrument with which he made observations from the window of his house, rendered no unimportant service by showing that the instruments need not be fixed on high towers; he also discovered, in the year 1673, the interesting and hitherto unsuspected fact, of the progressive transmission of light through space, and the appreciable velocity with which it travels. It was found, by comparing the times of immersion of the satellites in the planet's shadow and emersion from it, with the times calculated from the laws of their movements, that there was an acceleration or



retardation of the phenomena by a few minutes, plainly dependent upon the variations of the earth's distance from Jupiter; for the retardation was observed to be the greatest when the earth was in that part of its orbit most remote from him. The diameter of the orbit of the earth being at a rough estimate 183,000,000 miles, we are more remote from Jupiter, by the whole of that distance, at one time than at another; as, when the earth is in its orbit at a , its distance is greater from j , than when at b by the interval between the two points. But notwithstanding this immense addition of space, or any conceivable increase, an eclipse would be observed to occur no later at the one than at the other, if light were propagated instantaneously. Roemer found, however, a difference of eleven minutes to exist, which he afterwards estimated at fourteen, but which the precision of modern astronomy has fixed at sixteen minutes and a quarter. This determines the progressive motion of light, and the rate of its velocity. It requires time for its transmission; and flying over the diameter of the earth's orbit in sixteen and a quarter minutes gives it a velocity of eleven millions of miles a minute, or upwards of a hundred and eighty thousand miles a second. Thus, in the eighth

ASTRONOMY.—ITS EARLY DISCOVERIES.

disturbances. He himself had no gleam of the latter truth, but seems to have entertained an opinion that the irregularities occasioned by the mutual action of the planets and comets would probably go on increasing till the system either wrought out its own destruction or received repulsion from the direct intervention of its Creator. But Euler, Clairaut, D'Alembert, Lagrange, and Laplace have demonstrated the problem that the perturbations of the planets are periodic in their nature, that accurate compensation for them is laid up in store, so that the system is not arranged upon a principle of self-destruction. The elements of disorder and decay are removed from it. The very conditions of its existence guarantee its stability.

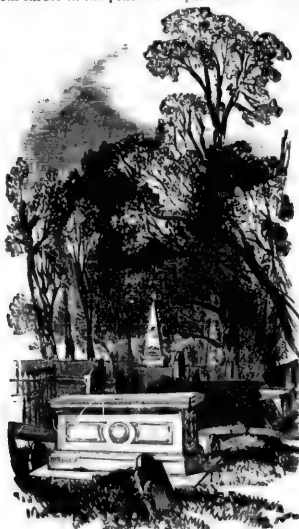
The house of Newton at Woolsthorpe, now the homestead of a farmer, has



Room in which Newton was born.

been in the ownership of persons anxious to protect it, and preserve every relic of its former occupant. The room in which he was born has the following inscription upon a tablet of white marble: "Sir Isaac Newton, son of John Newton, Lord of the Manor of Woolsthorpe, was born in this room on the 25th of December, 1642." The apple-tree, the fall of one of the apples of which, according to tradition, drew his attention to the subject of gravity, was blown down by a gale some years ago, and a chair was constructed out of its timber. The Royal Society of London possesses his telescope; the Royal Society of Edinburgh the door of his book-case; and Trinity College, Cambridge, has a lock of his silver white hair.

While the foundations of physical astronomy were laid by Newton, his confidant and friend, the brilliant and active Halley, pursued a remarkably successful career in the practical departments of the science. Leaving Hevelius and

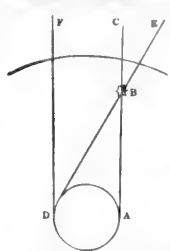


Halley's Tomb.

Flamsteed to keep guard over the northern hemisphere, he sailed to St. Helena to inspect the southern; and in honor of the reigning monarch who patronized the expedition, the oak which had screened him from his pursuers after the battle of Worcester, was raised to a place in the skies, forming the constellation Robur Carolinum. The object of the voyage was to determine the absolute and relative positions of the stars invisible to the European eye; but owing to the unpropitious climate of the island, only a catalogue of 360 was made after more than a year's residence. Upon this voyage the oscillations of the pendulum were observed to decrease in number as the instrument approached the equator; a fact noticed a few years previous by Richer, and explained by Newton to result from the greater intensity of centrifugal force there, proportionally diminishing the force of gravity. Halley was twice at Helena, twice in the Adriatic, once in the West Indies, now with Newton in his study at Cambridge, anon with Hevelius in his observatory at Dantzic, and then with Cassini watching a comet at Paris. Upon the death of Flamsteed, he succeeded to the office of astronomer royal, and though then in the sixty-fourth year of his age, he commenced the observation of the moon through a complete revolution of her nodes, involving a period of nineteen years, and lived to finish it, registering upwards of two thousand observed lunar places. It was while journeying in France towards the close of 1680, that he observed the great comet of that year, on its return from proximity to the sun; and being aware of the

conclusion of Newton, that such bodies describe very eccentric ellipses, his active mind began to study intently their phenomena, which resulted in a prophecy that has immortalised his name. After cataloguing and comparing a considerable number of comets, that of 1682 fortunately appeared. This he was led to regard as identical with those of 1460, 1531 and 1607, between which there is nearly the same interval. Hence he anticipated its return after the lapse of a similar period. "I dare venture," said he "to foretell that it will return again in 1758." This was a prediction announced in 1706, the accomplishment of which ranks with the greatest achievements of modern astronomy, and will perpetuate the fame of Halley to the remotest generations.

Bradley became the third astronomer royal upon the death of Halley. He had previously effected one of his two great discoveries, the aberration of the stars, an optical illusion, arising from the combined movement of the earth in space, and the progressive transmission of light; a discovery of the highest importance, requiring the greatest precision of observation to detect. Ever since the doctrine of the earth's translation in space had been received, astronomers had been anxious to find some parallax of the fixed stars, as a sensible confirmation of the fact. Although the whole diameter of the earth's orbit is relatively insignificant, it is yet absolutely vast. Hence it was deemed no unreasonable expectation that some small apparent change of place in the heavens would be discerned in the case of the fixed stars, when viewed from the two extremities of the earth's orbit—separated from each other by the mighty chasm of



a hundred and eighty millions of miles. To ascertain this, if possible, Bradley commenced observing a particular star γ Draconis, selected from its passing very near the zenith of their observatory. After a series of laborious observations, which began towards the close of the year 1725, this star was found to have a southerly motion, a result which excited profound surprise, as it was in a direction opposite to what would have been produced by an annual parallax. For instance, when the earth is in its orbit at A, the place projected in the heavens by the star B will be at c; but when the earth is in its orbit at D, provided that there be any sensible parallax, the star will be seen in the direction E. Instead of this being the case, the observed appearance was that of the star appearing from D in the direction F.

The observed change of place, then, could not be explained by means of parallax, or the earth's motion simply, because the change was in a direction opposite to what would have been caused by the parallactic motion. Suspecting some error, instruments were examined and observation renewed; but the fact was verified, and the star was found to move southerly from December to April, then to move northerly again, returning to its original place in the December following, after having described a small apparent orbit in the heavens. The diagram represents the apparent course annually described by γ Draconis, and other stars similarly situated. Imagine the line a bent overhead, z being the zenith, and p the pole. The ellipse represents the apparent movement of the star, the traverse diameter of which is about forty seconds; and s its mean place.

A aberration, or wandering, is the name given to this phenomena. The term is not strictly accurate, as the apparent movements thus denominated are not irregular, but uniform. Suppose a body to pass from A to B in the same time that a ray of light passes from c to B. Owing to the two motions, the impression of the ray of light meeting the eye of a spectator at s will be exactly similar to what it would have been if the eye had been at rest at s, and the molecule of light had come to it in the direction D, B. The star, therefore, whose real place is at c, will appear at D to the spectator at s.

The eighteenth century opened with lustre derived from the physical demonstrations of Newton, and closed magnificently with the telescopic discoveries of Herschel, by whose mechanical skill and matchless industry new regions were added to our solar system, and views unfolded of the infinity of the firmament, and the character of its architecture, which eye had not seen nor mind conceived.

The distinguished man, Sir William Herschel, was the son of a musician at Hanover, born November 15, 1738, and brought up to the profession of his father. He gradually relinquished his original calling in favor of astronomy, and rapidly rose to the highest eminence. Anxious to inspect for himself the sublime revelations of the heavens, but destitute of means to purchase a telescope of sufficient power for his purpose, Herschel resolved to employ some previous knowledge of optics and mechanics in the construction of an instrument. The earliest, a five-foot reflector, was completed in 1774; but altogether he accomplished the construction of upwards of five hundred specula of various sizes, selecting the best of them for his telescopes. After having established his fame by the discovery of a new planet, he completed the giant instrument that attracted travellers from all parts to the spot, and rendered his name a very familiar one throughout the civilized world. The tube was forty feet long, the speculum four feet in diameter, three inches and a half thick in every part, and weighing nearly two tons. Its space-penetrating power was estimated at 192, that is, it could search into the depths of the firmament 192 times farther than the naked eye. We can form no adequate conception of this extent, but only feebly approximate to it. Sirius, the brightest of the stars, is separated by a scarcely measurable gulf from us. But stars of a far inferior order of brightness are visible to the naked eye. These we may conclude to be bodies far more

renote, and reasonably suppose the star which presents the faintest pencil of light to the eye to be at least twice or thrice the distance of Sirius. Yet onwards, 192 times farther, the space-penetrating power of the telescope at Slough swept the heavens. It was completed in the year 1789, but the frame of the instrument becoming decayed through exposure to the weather, it was taken down by Sir John Herschel, the son of the constructor, in 1839.

It will be convenient here to notice a reflecting telescope of far greater magnitude and power, executed under the personal direction of the Earl of Rosse, and mounted in the park of Parsonstown, in Ireland. The mechanical difficulties involved in this work render the successful completion of this instrument one of the most extraordinary accomplishments of modern times; and entitle the projector of the ponderous instrument to the admiration of the world. The speculum has a diameter of six feet, and therefore an area of reflecting surface nearly four times greater than that of the Herschelian, and its weight approaches to four tons. It was formed into a telescope of fifty feet focal length, and is established between two walls of castellated architecture, against one of which the tube bears when in the meridian. Its light-gathering power is found on a very moderate estimate to be upwards of twenty thousand that of the unaided eye.

The solar system, including the planets, satellites and Halley's comet consisted of eighteen bodies when Herschel turned his attention to astronomy; but, before his career of observation terminated, he increased the number to twenty-five, and was the first of the moderns to detect an orb circling around the sun unknown to the ancients. It was on the 13th of March, 1781, that, turning a telescope of high magnifying power—though not his gigantic instrument—to the constellation Gemini, he perceived a cluster of stars at the foot of Castor, and one in particular, which sensibly increased in diameter while the rest of the stars remained unaltered. Two nights afterwards its place was changed, which originated the idea of its being a cometary body; an opinion embraced upon the continent when attention was called to it, but soon dispelled by clear evidence of its planetary nature. The new planet was named after the reigning monarch by the discoverer, but received his own name from astronomers, which was finally exchanged for the Uranus of heathen mythology. By this discovery the extent of the system was at once doubled; for the path of the stranger lies as far beyond what had been deemed its extreme confine, as that limit is removed from the sun. The first moment of his "attack" upon Saturn, upon completing the forty-foot reflector, he saw a sixth satellite, and a seventh a month later, now called Mimas and Enceladus. But Herschel realised his most surprising results from the observation of the sidereal heavens. The resolution of nebule and the Milky Way into an infinite number of stars—the discovery of new nebule of various forms, from the light luminous cloud to the nebulous star—of double and multiple stars—of the smaller revolving around the greater in the binary system;—these were some of his revelations to the world, as night after night he gauged the firmament. Caroline Herschel was the constant partner of her brother in his laborious undertakings—submitting to the fatigues of night attendance—braving with him the inclemency of the weather—noting down his observations as they issued from his lips, and taking, as the best of all authorities report, the rough manuscript to the cottage at the dawn of day and producing a fair copy of the night's work on the ensuing morning. He died in 1822; but she survived to 1848, witnessing the heir of his name recognized as the heir also of his talents and fame. It was one of the conceptions of this remarkable man—as bold an idea as ever entered the human mind—that the whole solar system has a motion in space, and is advancing towards a point in the heavens near the star λ Herculis. The opinion is now held the entire system is tracing out a curvilinear path in space—a course around some mighty centre.

The nineteenth century commenced with a fresh ingathering of members into the planetary family. It had been deemed a matter of surprise that the immense interval of about 350 millions of miles between Mars and Jupiter should be void, when only spaces varying from 25 to 50 millions divide Mars, the Earth, and the inferior planets. Kepler had therefore started the conjecture that a planet would be discovered in the vast region between the two former bodies; and thus bring it into something like proportion with the spaces between the latter.

The void in the series between Mars and Jupiter so convinced the German astronomers of the existence of a planet to occupy it, that a search for the concealed body was commenced. The anticipation was soon substantially realized by the discovery of the asteroids—Ceres, Pallas, Juno, and Vesta, revolving round the sun at a mean distance of 100 millions of miles from Mars, so small as only to be telescopic objects.

The career of planetary discovery which began with the century, was resumed in the year 1846; and has since been continued with most surprising results. Another miniature orb, Astræa, discovered by M. Hencke, was then added to the family of minute worlds rolling between Mars and Jupiter; and in one year alone, 1852, no less than eight such bodies were found. The known number at the date of August 2, 1877, was one hundred and seventy-three. Besides this, in the present age, the members of the solar universe have been increased by the detection of the primary planet Neptune, attended with a satellite; and of an eighth satellite of Saturn, called Hyperion, remarkable for its simultaneous discovery by independent observers, in 1848, Mr. Lassell, of Liverpool, and Mr. Bond, of Cambridge, in the United States.

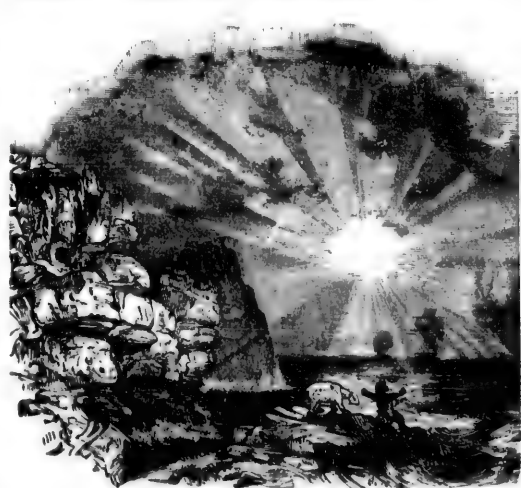
CHAPTER IV.

THE SUN AND SOLAR PHENOMENA.

The Sun, the central luminary of the system, the source of light and heat, appears to prosecute daily a stately procession through the heavens, owing to

the rotation of the earth upon its axis, ascending like an intensely brilliant ball from the eastern horizon and declining towards the western. Excepting the regions bordering upon the poles, every part of our globe, within the interval of twenty-four hours, is brought beneath the action of the solar rays, and withdrawn from them. The unflinching continuity and nice precision with which this has transpired, age after age, strikingly illustrate the stability of natural laws.

Light is sensibly transmitted to us while the sun is below the horizon. This is occasioned by the refractive and reflective properties of the atmosphere. At a farther distance from the horizon the rays pass over our heads into the upper regions of the atmosphere, and their direct transmission to the eye ceases. But they continue to reach us for an interval by reflection from the illuminated atmosphere, and produce the morning and evening twilight, the gradual transition from darkness to light, and from light to darkness. It is owing to the particles of air possessing the property of successively reflecting and re-reflecting the solar light, scattering it in every variety of direction, that all those objects are visible to us in the daytime, which are indirectly situated with reference to the luminary. Without it, the cloudless sky at noon, now so blue and brilliant, would present the blackness of darkness, with the exception of the places occupied by the sun and the stars. The latter would be as visible by day as at midnight, while no object would be perceptible, not receiving the direct sunbeams. The period of the sensible reflection of light from the sun, or the twilight, is generally supposed to be confined to his depression eighteen degrees below the horizon. The limit of depression, however, at which the greatest observed darkness commences, varies in different climates. In the torrid zone it has been found to be between sixteen and seventeen degrees; and in France between seventeen and twenty-one. The duration of the twilight is different at every different latitude on the earth, and it varies in the same latitude at different seasons of the year. Astronomically speaking, in the latitude of Greenwich, there is no night from the 22nd of May to the 21st of July, but twilight from sunset to sunrise. It reaches its minimum three weeks after the autumnal equinox, and three weeks before the vernal equinox, having a duration of one hour and fifty minutes. At midwinter it is longer by rather more than a quarter of an hour than at the former periods, though this is not often perceptible, but rather the contrary, owing to the greater prevalence of clouds and mists at the winter solstice, intercepting, absorbing, and reflecting away from the earth the rays of light that otherwise would visit it. The duration is least at the equator and greatest at the poles; but at the former there are two twilights every twenty-four hours, and at the latter only two in the year. At the north pole the sun is below the horizon for six months. If this region is thus for a long interval deprived of the solar presence, it is compensated by a lengthened possession of it at an opposite season of the year, for from the 20th of March to the 23rd of September, the sun is constantly above the horizon. The annexed view exhibits the sun as seen at midnight at the North Cape of Europe, which is within eighteen degrees of the pole—an appearance novel in the extreme to the dwellers in more southern latitudes.



SUN AT MIDNIGHT AT THE NORTH CAPE.

We are accustomed to speak of the meridian glory of the sun; and independent of the greater purity of the atmosphere at noon, through the dissipation of mists and vapors, a greater quantity of rays reach the eye from the sun when high in heaven than when near the horizon. The air is an absorbent as well as a refractive and reflective medium; and however transparent the medium may be, the quantity light absorbed will increase or diminish according to the extent of atmospheric space it has to traverse.

By a reference to the diagram it will at once be seen that a ray of light

ASTRONOMY.—SCENERY OF THE HEAVENS.

passing from z the zenith will embrace a much less portion of the atmosphere included between the two arcs than one from A the horizon; consequently a less quantity will be absorbed; and hence a celestial object will appear the brighter as its distance from the horizon increases. The comparatively dim and hazy appearance of objects seen in the direction of the horizon is not only occasioned by the rays of light having to traverse a larger space of the atmosphere, but of its lower strata, where it is the most dense and absorbent. It is estimated that the solar light

is diminished thirteen hundred times in passing through it, and we are thereby enabled to gaze upon the sun when setting without being dazzled by his beams. The apparent diameter of the grand orb varies slightly at different seasons of the year. This is owing to an actual variation of distance, for the ellipticity of the earth's orbit alternately increases and diminishes our proximity to the luminary. The solar diameter appears the least about the summer solstice, because the sun is then most remote from the earth. It is the greatest about the winter solstice, when the sun is at the nearest point to us. It seems extraordinary at first sight, that at mid-winter, when the streams are ice-bound, the snow lies upon the fields, and the traveler shivers in the blast, we should be nearer to the sun than when, at an opposite season of the year, the greensward is burnt up, the cattle pant in the shade of the trees, and men seek a cover from the solar heat. But the effect of the sun's rays is increased or modified by two circumstances, more than sufficient to counterbalance that of the varying distance: the length of time during which they act continuously, and their direction being more or less oblique. When he is farthest from us, as in summer, he is daily above the horizon twice as long as when he is nearest, at the winter solstice. This continued action causes a powerful accumulation of heat; and the nights being short, but little of it is radiated or given off during his absence. But temperature is affected by the direction of the sun's rays, whether vertical or oblique, their greatest force being experienced when they are perpendicular to the surface; while in proportion as they are oblique, they glance off, and having to pass through a larger portion of the atmosphere, a greater number are absorbed and dispersed by it. Out of ten thousand rays falling upon the earth's atmosphere, 8,123 arrive at a given point if they come perpendicularly, 7,024 if the angle of direction is fifty degrees, 2,831 if it is seven degrees, and only 5 if the direction is horizontal. Now in summer, the sun being north of the equator rises to a greater elevation in the heavens; the rays reach us in a more vertical direction; and the days being longer than the nights, more heat is absorbed than what is radiated. But in winter he traverses those signs of the zodiac that are south of the equator; and, ascending to a less elevation in the heavens, the rays reach us more obliquely, and the days being short, the solar action is less continuous.

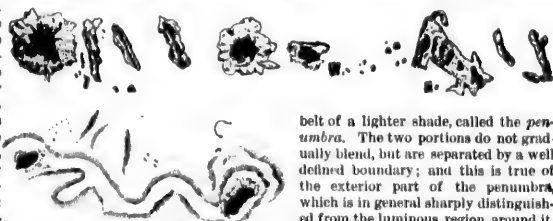
The mean distance of the sun from the earth is about 95,000,000 miles. The immense magnitude of the solar globe appears from the fact that it occupies so much space in the heavens and presents such a stately aspect, with so vast an interval between us. A locomotive traveling incessantly at the express speed of sixty miles an hour would not compass the distance between the terrestrial and the solar surface under a hundred and seventy-four years; and must have been started at the close of the seventeenth century to be now near the end of the journey. Though light comes to us from the sun in about eight minutes, a musket ball, retaining its initial velocity of 1440 feet a second, would require the term of ten years to pass over the same space. That an object therefore should be so splendidly visible as the sun, so far removed, and should so powerfully influence us with light and heat, argues grand dimensions and wonderful energy. Yet the whole amount of light and heat which the sun gives out to our world, is less than the 2,000,000,000th part of all the light and heat which he is dispensing at all times and in all directions. The solar diameter, 850,000 miles, is nearly equal to 107 times that of the earth. The volume of the magnificent orb exceeds that of our own globe upwards of 1,250,000 times; and is six hundred times larger than the united bulk of all the planets and satellites in the system.

To the naked eye the disk of the sun ordinarily presents a surface incomparably brilliant and uniformly luminous. There is no spot, or wrinkle, or blemish. The perfect purity of its aspect was an article of faith universally received by the ancient world. It was not till telescopic views had been obtained that the apparently smooth, unchequered, uniformly luminous face of the sun was found to be an illusion. Though ordinarily to the unassisted sight the sun exhibits a face of uniform and dazzling splendor, yet instances are recorded of his tarnished surface being perceptible to the naked eye. Herschel, who intently studied solar phenomena, and lost one of his eyes through the intense glare, mentions a spot appearing in the year 1779 large enough to be thus discerned. We have it upon the authority of Plutarch that in the first year of the reign of Augustus the sun's light was so greatly diminished that the unprotected eye might steadily contemplate his orb. Kepler states that once in his time the solar aspect was strangely altered, as though a thick haze enveloped his body; and the stars shone out at mid-day. Hakluyt gives the following from the log of a ship on the coast of Africa in December, 1590: "The 7th, at sunset, we saw a great black spot on the sun; and on the 8th, both at rising and setting, we saw the like, the spot appearing about the size of a shilling."

The spots are all evanescent, but some are sufficiently permanent to be recognized as the same after the lapse of a considerable period. They appear upon the eastern edge of the sun and move towards the western, vanishing when its edge has been gained, reappearing at the eastern extremity in about thirteen days and a half, to pursue the same route. When first seen upon the eastern limb they scarcely seem in motion, afterwards they appear to travel slowly, their velocity increasing till the central regions have been passed, when

they apparently relax and gradually disappear at the western extremity. This is obviously an optical illusion occasioned by the oblique direction in which we view the marginal parts of the sun's body. The fact sensibly demonstrates the solar rotation; but the period included between the appearance of a spot at the eastern edge and its return thither, is greater than the real time of one rotation owing to the earth advancing all the while on its orbit. The apparent interval of revolution is rather more than twenty-seven days; the true time of rotation is somewhat less than twenty-five days and a half.

Some general results of observation may now be succinctly stated. The spots are not uniformly obscure. They consist of a central portion, characterized by intense blackness, termed the *nucleus*, surrounded by a very distinct

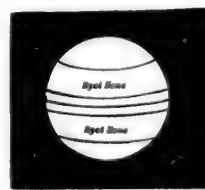


belt of a lighter shade, called the *penumbra*. The two portions do not gradually blend, but are separated by a well defined boundary; and this is true of the exterior part of the penumbra, which is in general sharply distinguished from the luminous region around it.

Both in form and dimensions the spots are subject to great changes, which transpire with astonishing rapidity. Two or more, situated very close together, will frequently expand towards each other and form one large spot. On the contrary, one of great extent has been seen suddenly to crumble into several smaller. These rapid and extraordinary changes indicate that the material subject to them cannot be solid or liquid, but gaseous.

It is a remarkable circumstance connected with the solar spots that they invariably appear near the equator, but apart from it. They have, however, been occasionally observed at a greater distance on both sides of the sun's equator, but never at the circle itself, or within several degrees of it. They are thus confined to two belts of the solar surface, parallel to its equator, corresponding in some degree to the sub-tropical zones of the earth.

It is an old observation that intervals of some length have occurred during which the disk of the sun has been comparatively pure, while at other intervals of corresponding extent it has never been seen wholly free from tarnish. It has also been ascertained, chiefly through the researches of the eminent physicist, General Sabine, that the years of greatest spot frequency are precisely those of greatest disturbance of our earth's magnetism, when auroral displays are most common and conspicuous. This bond of union between two sets of phenomena, so far distant and apparently so different in character, has recently been supplemented by the discovery of another, or that the epochs when the sun is most spotted are also those when cyclones are most common in the Indian Ocean—a connection which will probably be found to exist over the globe in general. The amount of heat received from the sun appears to be influenced by the prevalence of spots, and very likely this is the case with the extent of the rain-fall. Hence, it is beyond all doubt that an intimate and mysterious relation subsists between solar and terrestrial conditions, which physical inquirers may investigate with results of practical importance in the arrangements of life.



led to the conclusion that the spots are depressions below the luminous surface of the sun—temporary openings or rents in it—the bottom of which is the dark central part, or nucleus, while the sloping sides form the lighter shaded fringe, or penumbra. The altered appearance of the spots, as they are carried round by the solar rotation, strikingly confirms the fact that they are excavations; for after passing the centre of the disk, the penumbra is impaired on the side nearest to it, and gradually disappears; then the nucleus is nipped on the same side, till it vanishes; and then, finally, the penumbra on the opposite side begins to contract, and is carried out of sight. These variations are exactly those which depressions will present in the course of rotation. Sir John Herschel endeavored to account for these openings in the sun's vividly resplendent atmosphere by referring to the spots being limited to certain zones of the solar surface, to which the sub-tropical zones of our own globe assimilate in position. These are well-known regions where storms of tremendous violence are of common occurrence, accompanied with vorticeous movements of the air, though upon a puny scale as compared with the physical operations naturally expected to be in process in a body of almost immeasurably greater magnitude. But respecting the genesis of sun-spots, whether produced by an uprush of intensely heated vapor, or by a comparatively cool descending current, or perhaps by both, we are yet very much in the dark.

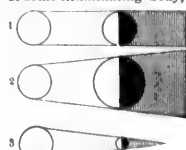
Our knowledge respecting the constitution of the mighty orb, physical and

ASTRONOMY.—SCENERY OF THE HEAVENS.

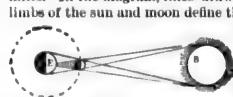
chemical, has made surprising progress in very recent years. The advance spoken of is mainly the result of rigorous research with new methods of investigation, as the application of photography to the observation of celestial objects, and the energy with which in skilled hands spectroscopic analysis has been prosecuted. Thus it has been decisively shown that a comparatively thin layer of red vaporous matter forms the external coating of the solar globe, called the chromosphere. Below is the photosphere, the light-giving sphere of the sun, with its spots, facule, and strange mottling. Above, an immense atmosphere extends. We have also sensible evidence that the colored envelope, glowing with the intensest heat and light, is from time to time broken through from beneath as if by tempests, in comparison with which the fiercest hurricanes of our tropics are insignificant. These solar storms carry up the glowing vaporous matter in sudden and powerful jets thousands and thousands of miles above the general surface, and originate the so-called "red flames," or roseate prominences, first noticed only in connection with total solar eclipses, but which may be seen at any time when the sun is unclouded, owing to the powerful spectroscopes now constructed.

It is an interesting circumstance that a considerable number of substances with which we are familiar are found in a state of vapor in the envelope and its prominences, as well as aloft like detached clouds in the solar atmosphere. Hydrogen is there as a prime constituent, with sodium, potassium, magnesium, calcium, chromium, manganese, zinc, copper, nickel and others. So recently as August, 1877, Dr. H. Draper, of New York, announced the presence of oxygen in the sun, which according to the lowest estimate, forms one-third of the entire mass of the earth; and probably the central body of the system, with all its other members, are composed of elements known to be terrestrial, though perhaps some what differently proportioned.

In the class of solar phenomena, eclipses of the sun are always interesting, and sometimes imposing. A solar eclipse is caused by the dark body of the moon interposing between the sun and the earth, and deflecting a shadow upon the latter. The shadow cast by an object is merely an interception of the light of some illuminating body, and has its shape and extent determined by the form and relative magnitudes of the two. If the moon were as large as the sun, her shadow would be cylindrical, like the first figure, and of an unlimited length. If she were of greater magnitude, it would resemble a truncated cone, the diameter and length increasing to an indefinite extent, as in the second figure; but being immensely inferior to the sun, she projects a shadow which converges to a point like that in the third figure. This shadow, at the distance of the earth



from the moon, can never be more than about one hundred and seventy miles broad, and consequently the sun can never be totally eclipsed at the same instant over a greater extent of terrestrial space. But as the earth is continually moving, the shadow is a passing traveler, and sweeps over it; no total obscuration of the sun lasting longer at one spot than about eight minutes. Although the limits within which an eclipse is total are very circumscribed, it will be more or less partial over an area having a diameter of five thousand miles. In the diagram, lines drawn to the earth from the upper and lower limits of the sun and moon define the conical shadow projected by the latter, or the umbra, which, wherever it falls, occasions a total obscuration of the solar orb.



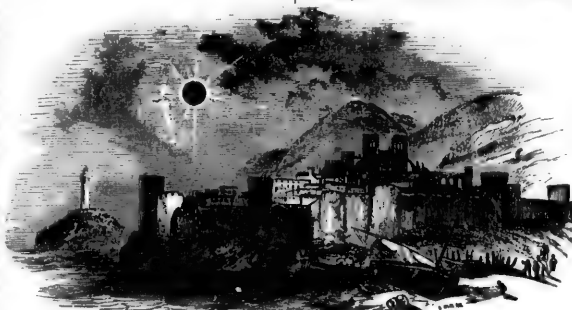
Similar lines drawn to the earth along opposite edges of the two bodies define the limits of a fainter shadow, or the penumbra, caused by the moon only hiding parts of the sun's disk; and within the space it includes, the eclipse is more or less partial, according to the situation of an observer.

There may be five solar eclipses in a year, and the least number which can take place is two. As the moon passes through that part of her orbit which lies between the sun and the earth once a month, we should obviously have an eclipse every month, every new moon, if she moved in the plane of the earth's orbit. This is, however, not the case—the lunar path is inclined to that of the earth. She is above it during one-half of her course, and below it during the other, crossing it twice a month at two opposite points, called her nodes. It is only when the moon is between the sun and earth, at or very near her node, that is, when her path cuts the plane of the earth's orbit, that she intercepts to us the solar light and eclipses occur; at other times, she passes either above or below the sun as seen from the earth, and the earth passes above or below her shadow. Owing to the irregularity of the moon's motions, she does not cross the plane of the earth's orbit at the same point in every revolution, but these points shift through a certain interval, after which the same change is repeated and the same cycle of eclipses occurs. This interval includes 223 lunations, or a period of eighteen Julian years and about eleven days. It was known to the astronomers of antiquity, and enabled them to predict with tolerable exactness

lunar eclipses, as their recurrence is very readily observed, being visible in all parts of the earth which have the moon above their horizon, and having everywhere the same magnitude. It is otherwise with solar eclipses, for though they recur in the same fixed order within the cycle, they vary as to the localities in which they are visible, and as to their appearances.

Though solar eclipses are of common occurrence, yet a total one depends upon a conjunction of so many circumstances that the spectacle happens only on very rare occasions even anywhere on the surface of the earth. Halley, in a paper on the total eclipse of the sun which happened at London on the 3rd of May, 1715, remarked that there had not previously occurred a similar event, visible in that city, since the 30th of March, 1140—the reign of Stephen—an interval of five hundred and seventy-five years. The total obscuration lasted three minutes and twenty-two seconds. The planets Jupiter, Mercury, and Venus, with the stars Aldebaran and Capella, were visible to the naked eye.

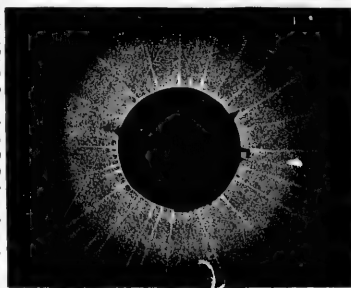
The darkness which attends full solar eclipses appears to vary, owing chiefly to a difference in the condition of the atmosphere, and the time of the day. Though strongly marked on all occasions, it is more peculiar than profound; and altogether confined to the brief period of totality. So long as the smallest portion of the lustrous orb is visible, there is considerable light. Nature simply looks sobered and saddened till the moment of entire obscuration arrives. Then, besides the sensible diminution of light, a strange spectre-like aspect is stamped upon the appearance of every object—sky, clouds, trees, buildings, mountains, streams, animals, and man—producing an effect which is unexpected, sublime and even appalling. Equally startling and remarkable is the change upon the first re-appearance of the solar ray. When totally obscured by the body of the



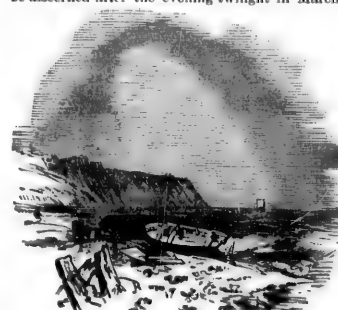
Annular Eclipse.

moon, the place of the sun is made apparent by the brightness of that part of the heavens in which it is situated. The brightness appears in the form of a *corona*, or halo of whitish light, in some places extending into long gleams.

A delicately luminous cone is sometimes seen accompanying the sun, extending from the horizon obliquely upwards in the direction of the zodiac, and therefore called the *Zodiacal Light*. It appears before sunrise and after sunset, but is never seen



by us so well defined as in the equatorial regions, though it may frequently be discerned after the evening twilight in March and April and before the morning twilight in September and October. The light resembles in appearance the tail of a comet. Its color varies according to the state of the atmosphere, but it is generally of a pure rose tint. The brightness also varies, and some years it has never been seen at all. Its extent from the sun, situated at its base to the vertex, varies from 45° to 50°, and its breadth at the base from 30° to 35°. It has been conjectured that it derives its form—that of a long and narrow ellipsoid,



Zodiacal Light.

only the half of which we see—from its rapid revolution with the sun on its axis; but the nature of the phenomenon itself is one of those points respecting which we are compelled to confess our ignorance.

The decline of the sun to the horizon is as imposing a spectacle as his advance to it, when the atmosphere favors the exhibition of the descent. The most gorgeous sunsets are those of the West Indies, during the rainy season. The sky is then sublimely mantled with gigantic masses of clouds, which are tinged with the glare of the descending luminary, and which seem to be

ASTRONOMY.—SCENERY OF THE HEAVENS

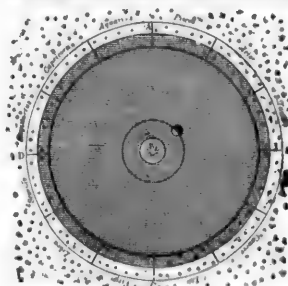
patiently waiting for his departure in order to discharge their pent-up wrath on the bosom of the night. In the South Atlantic the sunset has a milder and more sober aspect. In the Eastern tropics it has generally an over-powering fierceness, as though the last expression of the solar heat should be the greatest. But during the summer, in temperate latitudes, there is often a serenely beautiful horizon, a mellowness of light, together with a rich and varied coloring of the sky.

CHAPTER V.

MERCURY—VENUS—THE EARTH.

To a superficial observer of the heavens at night when the moon is absent, only one class of objects will be apparent—the stars. But a little attentive observation will discover other bodies, which besides taking part in the apparent revolution of the celestial concave, will be found to have independent movements. They seem stationary at intervals, then in motion from west to east, and going back again from east to west, their positions constantly changing in regard to the earth, to each other, and to the host of stars. These peculiarities were marked in very early times, and in allusion to them the Greeks applied to such bodies the term planet, which signifies to wander. Their course, capricious and uncertain to the ancient eye, is now discerned to be a direct and regular highway. The planets are divided into primary and secondary. The former revolve round the common centre of gravity in the system; the latter officiate as satellites to the primaries in their great pilgrimage, and combine with it a revolution round them. The planets are also divided into inferior and superior, referring to their distance from the sun being less or greater than that of the earth. Mercury and Venus are the only inferior planets, always on the same side of the earth as the sun, hence never seen at midnight except in very high latitudes. Both were known to the ancients, with Mars, Jupiter, and Saturn being visible to the naked eye. Uranus may occasionally be thus discerned. But Neptune, with all the planetoids except Vesta, and all the satellites except the moon, are telescopic objects. Their astronomical symbols are: ☿ Mercury, ♀ Venus, ⊕ the Earth, ♀ Mars, ♃ Jupiter, ♄ Saturn, ♅ Uranus, and ♆ Neptune.

The paths of the planets are elliptical, as previously described; but the ellipses vary to some extent in their eccentricity, or as to the distance of the sun from the centre of the oval, which here represents a planetary orbit. This distance in the case of Mercury is about seven millions of miles; in that of Venus it is less than half a million; in that of the Earth it is somewhat more than a million and a half; in that of Mars it is upwards of thirteen millions; while in that of Juno and Pallas it is sixty-four millions and a half. The orbits of the planets are more or less inclined to each other, instead of lying in the same plane. It may be desirable here to explain the meaning of this oft-recurring phrase. Referring to the earth, an imaginary smooth and thin surface, cutting through the centre of the sun and reaching out to the fixed stars, is the plane in which the earth moves in revolution around the sun. This is represented by the shaded part of the diagram.



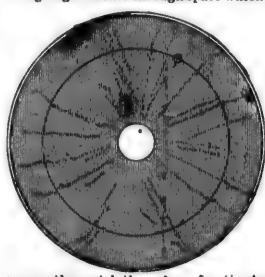
planet. The mean velocity of the planets in their orbits exhibits great diversity, those which are nearer to the sun being far more rapid than those which are remote. Saturn prosecutes his circuit at the sober pace of little more than twenty thousand miles an hour, while Mercury rushes on at a rate which is more than five times that speed. The extraordinary swiftness of the inferior planets is obviously necessary to counterbalance the powerful attraction of the solar mass, which acts with diminished force upon the bodies that are more distant from him.

Mercury, the nearest planet to the sun, is the smallest primary in the system, with the exception of the asteroids. It is the fastest traveler also, having a velocity in space which is nearly twice the rate of the earth's orbital motion. It is the densest celestial body with which we are acquainted, supposed to be fourteen times that of water. A globe of lead therefore, of the same volume, if weighed in the balances against its mass, would be found wanting. Yet notwithstanding this remarkable density, if loosened from the centrifugal force it would require more than a fortnight for the planet to accomplish its dash heading to the sun. The days and nights are about the same length—our own; but a whole cycle of seasons has been four times gone through before the earth, summer, autumn, and winter have once revolved. Owing to comparatively near neighborhood, the sun will occupy seven times more space

in the Mercurian heavens than in ours, and afford a light and heat which would be intolerable to our organs without some modifying circumstances.

Mercury is at a mean distance of thirty-seven millions of miles from the sun, and performs an orbital revolution in about 88 days, traveling at the rate of more than a hundred thousand miles an hour. This speed originated the name—that of the swift-winged messenger of the gods. The planet rotates upon its axis in rather more than twenty-four hours, and has a diameter of 3000 miles. Its volume must therefore be increased upwards of twenty millions of times in order to equal the sun in magnitude; but the mass, if increased only two millions of times with matter of the same density, would be equal in weight. Mercury is an evening star when eastward of the sun, and a morning star when westward of him, but is quite invisible to the naked eye, owing to the vicinity of the solar splendor, except at or near the time of the greatest elongation. The telescope discovers phases like the moon and atmospheric indications. Some have even professed to discern irregularities of outline, supposed to express superficial elevations, but of this we have no certainty.

Astronomers have been sorely plagued in their observation of Mercury—a rapid planet—imperceptible generally, through a close attendant upon the sun never at such a distance from him as to appear in a dark part of the heavens—and going at a rate through space which is a perfect gallop when compared with



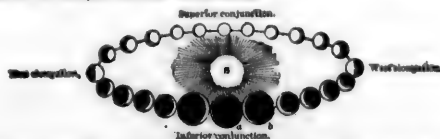
the sober jog-trot of the earth. When between us and the sun, and at the same time in the plane of the earth's orbit, Mercury transits the solar disk and is seen as a small black speck upon the surface, an evident proof of the borrowed radiance of the orb.

The recent transits of Mercury have been chiefly interesting on account of the accuracy with which they have been predicted. Formerly owing to difficulties of observation, the tail of the planet's motions were so imperfect, that there was no certainty respecting the exact time of the phenomenon. Gassendi

was on the watch three days for the transit he witnessed. Hevelius and his assistants were kept waiting at the telescope four days. Both Halley's and Laalande's calculations were wrong by three quarters of an hour with reference to the transit of 1786. At a later date the errors amounted to minutes. At length, in 1844, Leverrier took the planet in hand, instituted a profound examination into the theory of its motions, and constructed tables which represent them with wonderful precision.

VENUS. The nearest planet to the earth, and the second in point of distance from the sun, Venus is the most beautiful of his satellites and brilliant of stars. Like Mercury, she never adorns the midnight sky, nor has she ever been seen rising in the east while the sun was setting in the west, or on the meridian at either sunrise or sunset. This shows her path to be comparatively near the throne of the great luminary, from whom she never departs more than 48°, rather more than half the space from the horizon to the zenith; and to be inferior to that of the earth, while exterior to that of Mercury, whose greatest elongation, or distance from the sun, is little more than 38°. In addition to this she has been observed to eclipse Mercury, a clear proof of her position in space being external to him, an instance of which occurred on the 17th of May, 1773. Venus is alternately a morning and evening star, visible for about three hours after sunset, and as long before sunrise. This bright herald of the sun's advance to the eastern horizon, and his faithful follower to the western, were once supposed to be distinct bodies.

Venus is situated in the system at a mean distance of sixty-eight millions of miles from the sun, through which she would fall in thirty-nine days and a half, if surrendered solely to the attraction of his mass. Her periodical revolution is accomplished in 224½ days, involving a velocity of 80,000 miles an hour. The planet is rather smaller than our own globe, having a diameter of 7700 miles. She rotates upon her axis in about 28½ hours. Venus exhibits alternately a fine thin crescent and a semicircle like the moon, but she can scarcely be seen quite full, because when the whole of her enlightened hemisphere is turned towards us, she is either behind the sun or so near him as to be hid by the splendor of his light. The diagram represents the various appearances of the planet as she moves in her orbit, in the order of the letters.



We first behold Venus as a morning star for a short time before sunrise, soon after passing between the earth and the sun at her inferior conjunction, when she appears crescent-shaped as seen through a telescope. She continues gradually to gain upon the sun, rising earlier and earlier, until her greatest angular distance westward has been attained, when she exhibits a semi-circle, and shines with great splendor. Then the planet begins to return towards the luminary, making the same daily progress as in separating from him, rising later and later, diminishing also in brilliance, owing to the overpowering solar glory, in which she is lost at the time of her superior conjunction being then behind

the sun in relation to us. A few days afterwards Venus becomes an evening star, and is seen a short time east of the sun after his setting. She soon seems to have fallen considerably behind him, and continues to depart farther and farther, setting later every night, until her latest elongation eastward has been reached, when she again exhibits a bright semicircle. The course towards the sun is then resumed, until she comes between him and the earth, sets with him, and is invisible, owing to the whole of her enlightened side being turned away from us. In a few days the phenomena of the morning star are repeated. Venus is seen to keep on the same side of the sun for a period of about two hundred and ninety days together. This seems at first sight a singular anomaly, as it is a greater interval than that occupied by an entire circuit around him. It is, however, at once accounted for by considering that the earth is proceeding at the same time in the same direction, though at a slower pace. The planet accomplishes an angular motion of $1^{\circ} 36'$ per day, while the earth follows at the rate of $56'$, and is thus gained upon by only $37'$ daily. But the two planets will obviously appear to keep on the same side of the sun until Venus has gained half her orbit in advance, or 180° . This it will require about two hundred and ninety days to effect, as the difference of their daily rate, $37' \times 290 = 10730' = 180^{\circ}$ nearly. It will be seen from the diagram, that at the time of the inferior conjunction, the unenlightened half of the orb is turned towards us. Did she present in that position her illuminated side, we should see the planet as a small brilliant moon, shining with twenty times her ordinary lustre, as she is then a hundred and sixty millions of miles nearer the earth than when at the opposite point. As it is, however, she is our best friend among the stars, the most radiant of the host, and has been observed to cast a clearly defined shadow.

This planet, like Mercury, transits the sun's disk, and then appears shorn of her beauty, under the form of a dull dark spot.

The transits of Venus are of special interest from their rarity and great physical importance. They occur at intervals of eight years, a small section of individual life; but alternating with intervals of more than a century, during which whole generations pass away, thrones crumble, and dynasties change. They are of importance as the very best means of ascertaining the distance and volume of the sun, which supply data for determining the distances and magnitudes of the planets, and serve as a universal standard of astronomical measurement.

But little is known of the physical constitution of Venus, owing to the intense splendor with which she shines. The existence of a considerable atmosphere is inferred from the appearance of a penumbral light around the planet during her transits, as well as from a faint radiance observed to stretch beyond her directly illuminated hemisphere. The line in the annexed uppermost figure marks the boundary of the direct influence of the sun's rays; and the upper and lower projections beyond it show the twilight, which is referred to atmospheric reflection. Variable and fleeting spots have also been repeatedly noticed, as in the second figure which naturally leads to the supposition of an atmosphere charged with clouds and vapors, with water upon the surface, from which they are formed. The conclusion that she has mountains and valleys rests upon the fact that the edge of her enlightened part appears shaded, that her corners are sometimes obtuse, and present a luminous point apparently detached from the planet. Schroeter regarded this as the summit of a high mountain, illuminated by the sun after he had ceased to be visible to the rest of that hemisphere. If these conclusions may be depended upon, and they are warranted by strong evidence, Venus presents striking points of analogy to the constitution of the earth. An atmosphere reflecting light, the medium of sound, and a highway for "fire and hail, snow and vapor,"—a superficies exhibiting the diversities of land and water, hill and vale—these are some of her probable attributes, features expressing a family likeness to our globe, and indicating the action upon her surface of that mighty upheaving agency, which, in bygone ages, piled the Alps, and reared the ramparts of the Himalaya.

THE EARTH. We now come to the abode of Man—the cradle, the home, and the grave of our race for a long series of generations—its third planetary body in point of distance from the central sun, and the first in the system of which we have certain knowledge of it being dignified with the presence of an attendant orb. The introduction of our globe to a place among celestial objects involves an apparent contradiction; yet such is its real character in the constitution of the universe, and such is its obvious aspect as viewed away from its surface. To rustic ignorance it will seem a statement palpably absurd, that any affinity exists between the earth and the stars in the firmament. They are mere points of light in the sky, and have no perceptible dimensions, whereas our world appears of immeasurable extent, and exhibits no luminosity like theirs to the eye of sense. It seems, too, a perfectly inert mass. There is no movement discernible independent of that of the rivers flowing in their channels, the seas tossing in their bed, and the forests bending to the gale, while the celestial bodies appear in constant procession from place to place in the concave of the heavens. There is nothing, however, more susceptible of demonstration than that the obvious state of our globe is not its actual condition—that the apparently quies-

cent habitation of mankind is an unceasing traveler in space—that its opaque mass exhibits the same luminous aspect to the nearer planets which they present to us—and that in structure and economy the earth is in fraternal relationship to the celestial host, and may be denominated, with perfect propriety, a star.

To the eye the earth appears an immense plain stretching out in all directions to an indefinite extent. But a few simple facts prove the suggestion of the senses here to be erroneous. The limit of vision to the traveler upon an extensive level, or to the mariner at sea, is a well defined circle of which the observer is the center; and it may be geometrically proved, that this circular horizon is a certain indication of the circular figure of the body to which it relates. In any direction in which a ship leaves shore, or approaches the coast, the vessel is observed as if gradually sinking in the ocean, or rising from it—evidence of the convexity of the water between the eye and the object. We also find, that during a lunar eclipse the shadow projected by the earth upon the disk of the moon is always of a circular shape. The common occurrence now of a voyage around the world, proceeding in the same general direction, east or west, and arriving at the same point again, demonstrates the figure of the earth to be either that of a sphere or a cylinder; and the latter is disproved, and the convexity of the surface shown, north and south, by the gradual declination or rise of the north and south circumpolar stars, as the equator is approached or receded from. Our terrestrial mansion, therefore, is a vast mass of matter of a spherical form like the planets whose round disks are the objects of telescopic observations. The spherical figure of the planetary bodies—a result of the law of gravitation—is, on many accounts, the best shape they could have assumed. The same phenomena could not have been offered to their surfaces, with the same machinery, supposing any other form. Had the earth been a rotating cylinder, the solar beams could not have reached its two extremities together, or its general superficies with either extremity. But it is only an approximation to the truth of its actual shape, to speak of our world as having a spherical form. It is not a globe whose circumference is everywhere at an equal distance from the center, a property essential to a sphere. A process of reasoning led Newton to the conclusion, that the circle of the earth's daily rotation upon its axis being the greatest at the equator, the consequent greater action there of the centrifugal force would produce a bulging out of the surface in the equatorial regions of a yielding mass, and a flattening at the poles; and this deduction from the laws of forces has been proved to be correct by the actual measurement of the lengths of degrees of the meridian, made with care and precision by the commissioners of various nations. The certain conclusion obtained is, that our globe is an oblate spheroid, an orange-shaped ball, compressed at the poles, and elevated at the equator, having the following dimensions:—

Diameter at the equator	7925-648 miles
Diameter at the poles	7899-110 "

The length of the axis of the poles is thus about twenty-six miles and a half less than the diameter of the equator. It is highly improbable that any error of importance exists in this measurement, founded upon the principle first employed by Eratosthenes, when he attempted to determine the value of an arc of the meridian between Alexandria and Syene.

Sir John Herschel considers it unlikely that an error to the extent of five miles can subsist in the diameters; and the equatorial diameter gives an extent of nearly twenty-five thousand miles, accurately 24,800, as the value of the equatorial circumference.

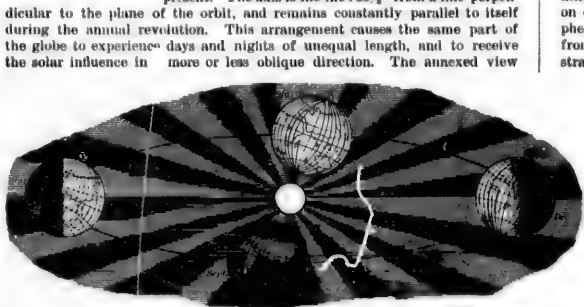
The earth has two principle motions, a rotation upon its own axis, and a translation in space. We can obviously have no ocular evidence of the diurnal rotation like that which we obtain in the case of the sun and some of the other planets, by observing the movement of spots upon their surface. But we have ample proof of the fact. There is absurdity upon the face of the ancient doctrine, that the daily apparent procession of the heavenly bodies around the earth is a real progress—that a point utterly insignificant when compared with the general aggregate of stars is a centre around which they circulate; and when we think of the inconceivable velocity with which they must travel, in order to compass the immeasurable circle which in that case they describe, the absurdity heightens. The rotation of our globe is not, however, a doctrine based on probabilities. The experiment of falling bodies descending in advance of the plumb line is direct and positive demonstration of the fact, corroborated by the diminution of the force of gravity at the equator. According to Laplace, the chances are eight thousand to one that the earth so revolves. The rate of the earth's rotation at the equator, where the circle of the circumference is the greatest, is about sixteen miles a minute. Its velocity, at thirty degrees of latitude, which is below the most southerly point of Europe, is computed at fourteen miles in the same time; and at forty-five degrees, or about the centre of France, it is eleven miles.

The other principal motion of our globe is its translation in space. This appeals not to our senses like the orbital movements of the surrounding planets, but it is supported by irrefragable evidence. It accounts for the phenomenon of the apparent annual revolution of the sun, as an actual transit is a vessel on the water accounts for the apparent movement of the banks of a river, or the shore of the sea. It satisfactorily explains the seeming anomalies of the planetary paths. It has received direct confirmation from the aberration of the stars, and may be regarded as established on the firm basis of demonstration. Situated in space at the distance of ninety-five millions of miles from the sun, the earth has an orbit of nearly six hundred millions of miles to travel over. This circuit is performed at the mean rate of sixty-eight thousand miles an hour. Supposing the impulse that appoints this path to be withdrawn, in sixty-four days and a half, the terrestrial world would crash with the solar surface, and sink into its mass like a millstone in the sea, owing to its greater density. That diversity of seasons which marks the year of our globe is the joint result of its movements, and of the inclination of its axis to the plane of its orbit. Supposing one of the poles to



ASTRONOMY.—SCENERY OF THE HEAVENS.

be always pointed towards the sun, as in *fig 1*, then, notwithstanding the daily rotation and the motion in space, the regions from the poles to the equator would be one half in constant light and the other half in constant darkness. Or supposing the equator always pointed directly towards the sun, as in *fig 2*, light and darkness would alternate for equal times on all parts of the globe; and there would be different seasons at different places, but no change of seasons in every place as at present. The axis is inclined $23\frac{1}{2}^\circ$ from a line perpendicular to the plane of the orbit, and remains constantly parallel to itself during the annual revolution. This arrangement causes the same part of the globe to experience days and nights of unequal length, and to receive the solar influence in more or less oblique direction. The annexed view



represents the earth in four different parts of its orbit. It illustrates the varying direction of the sun's rays to the same regions of the globe, and the varying duration of the diurnal exposure to their action, and withdrawal from it. Thus, at the vernal and autumnal equinoxes, it will be seen, that the sun's light reaches equally from pole to pole, so that each part of the surface is carried by the daily rotation into light and darkness of the same duration. At the summer solstice, as the earth rotates, the whole arctic circle enjoys continued day, while the north temperate zone has not only long days and short nights, but receives the sun's rays less obliquely than at the former periods, and consequently experiences an increase of temperature. A precisely opposite effect takes place in the same region at the winter solstice.

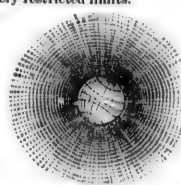
There is a third motion to which the earth is subject, occasioning what is called the precession of the equinoxes. Wherever, in spring and autumn, the sun, in his apparent annual course, crosses the equinoctial, or the circle of the earth's equator extended to the heavens, there are the vernal and autumnal equinoxes. These points are found to have a constant motion westward, at a very small yearly rate, but which effects considerable alterations in a series of ages. To give a familiar illustration of the fact, we may suppose three roads to extend around the earth: one running due east and west, representing the equator or equinoctial; another, proceeding above and below the former, crossing it at two opposite points, representing the ecliptic; a third, crossing the first at right angles, at the points of intersection with the second, representing the prime meridian, or initial point of longitude. We may now suppose a carriage to be started along the ecliptic from the common point of intersection, returning, after a complete circuit of the earth, not to the place from whence it started, but passing the equinoctial about a

hundred rods to the west of it. The repetition of this at each circuit, the more westerly intersection of the roads, will illustrate the annual retrograde movement of the equinoctial points, termed on account of its effect in accelerating the time of the equinoxes, their precession, or going forward. This movement, first observed by Hipparchus, causes a progressive increase of the longitude of the stars, and has been clearly shown to be a necessary consequence of the rotation of the earth, combined with its elliptical figure, and the unequal attraction of the sun and moon on its polar and equatorial regions. The mass of matter about the earth's equator being greater than at the poles, the former is more powerfully acted on by the law of attraction than the latter, which produces a slow reeling motion of the axis of the earth from east to west, and the retrocession westward of the equinoctial points. The retrogradation is at the rate of about $50\frac{1}{2}''$ in a year, or $1''$ in $71\frac{1}{2}$ years, so that in a period of 25,000 years the equinoxes will accomplish a complete revolution along the circle of the ecliptic. While the plane of the earth's equator, or the equinoctial, thus experiences a constant displacement from the action of the sun and moon, it is a remarkable and well ascertained fact that the plane of the earth's orbit, or the ecliptic, is subject to a slow annual displacement, which diminishes its obliquity, an effect due to the bulging which our globe endures from the other planets, chiefly from the attacks of Jupiter and Venus. In consequence of this, the tropics are slowly and steadily approaching the equinoctial, so that the sun does not now come so far north of the equator in summer, nor decline so far south in winter, by a degree, as he must have done six thousand years ago.

In the interval of two thousand years ago, however, the obliquity of the ecliptic has decreased by only $28' 48''$. There is little ground, therefore, for the apprehension of the seasons being annihilated owing to the ecliptic coinciding with the equator, and equalizing the length of our days and nights. The event is far away in the womb of the future, even supposing the diminution to go on without check. But the theory of gravitation tells us that it will at

length cease, and an increase of the obliquity set in, to decrease again and increase, oscillating about a mean position within very restricted limits.

One of the most important attributes of our globe as a planet is the gaseous envelope that encloses it on all sides—the atmosphere—essential to the vitality of its organized occupants, man, brute, bird, and plant, but chiefly interesting to the astronomer from its influence in displacing celestial phenomena by its refractive power, and diffusing the rays of light so as to surround us on every hand with visible glories. The atmosphere rapidly diminishes in density as we recede from the surface. The diagram exhibits various strata of air resting upon the earth, the upper pressing upon the lower, and



causing the interior to be more dense than the exterior strata. It is not known how high this elastic medium extends. As deduced from the duration of twilight, the ignition of meteors, and the appearance of auroral arches, the earth's atmosphere is supposed to extend to the height of from fifty to sixty miles. But the chief peculiarity of our planet is the presence of a secondary body as a satellite, reflecting to its surface the light of the sun in the absence of his direct rays. It has indeed been supposed that Venus is similarly dignified, and we are not in circumstances to say positively that this is not the case, either in relation to her or Mercury, as such an attendant, if small, might exist, and have hitherto escaped notice, owing to the position occupied by those bodies. Cassini and others have imagined they perceived a satellite attending Venus, but the observation has not been verified.

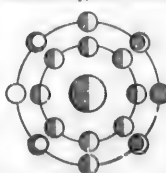
The terrestrial world occupies a favored place in the system, a position from which nearly all the sister planets are visible to the naked eye, It will not be seen itself by the inhabitants of Uranus, and be scarcely perceptible to those of Saturn. As an interior planet to Jupiter and Mars, it will appear occasionally as a spot upon the sun's disk, performing similar transits to those of Venus and Mercury. Its great division of land and water, the outlines of its continents and seas, with its masses of ice and snow at the poles, will be seen from Mars; and at the time of the inferior conjunction of Venus, when she is not more than twenty-six millions of miles removed from us, our globe will exhibit a full orb, shining with great splendor through the whole of her night.

CHAPTER VI.

THE MOON AND LUNAR PHENOMENA.

NEXT to the greater light that rules the day, the most useful and interesting to us of all the bodies in the universe, is the lesser light that rules the night. The proximity of the moon, the relation in which she is linked to the earth, the power she exerts upon the ocean in drawing up its billows, and the great importance of the lunar theory to safe navigation, have intently fixed the eye of science upon her orb.

Upon first becoming visible in the course of lunation, the moon is seen soon after sunset as a thin crescent in the west with its convex side towards the sun. Gradually the breadth of the crescent increases, the inner curve is changed into a straight line, and she exhibits a complete half circle in the heavens. Afterwards, the line becomes a curvature again, bulging out in a direction opposite to its former inclination, and the moon is said to be gibbous, that is, hunched or convex. The curve turned from the sun continues to strengthen, and the apparent breadth of the moon to increase, until she is a full or circular orb, when a repetition of the same phases in inverse order commences. At length she appears like a fine thread of light in the morning, a little west of the rising sun, and for a few days she is lost to view, being in conjunction with him. The lunar phases clearly prove that the material of the moon is in itself as dull and opaque as the rock we gaze upon in our own world, that she shines by virtue of the reflected light of the sun, a fact recognized in the earliest ages, and apparent from the different appearances presented by those parts of her surface which are turned to and from his beams. The earth appears in the diagram as the central body, with the moon in eight different parts of her orbit, receiving the



light of the sun. The outermost circle exhibits the appearances presented to a terrestrial spectator in each station of the lunar globe, a crescent, a semicircle, gibbous, and full. It is evident, therefore, that the satellite is not self-luminous, otherwise she would always appear as a round full orb. After solar phenomena, the lunar phases are the most beautiful celestial objects; and but for their periodical return and frequent observation, they would excite enthusiastic admiration. If for long and indefinite intervals the earth was deserted by its attendant, the renewal of the crescent moon would meet with a marked and general welcome, like that which the inhabitants of polar regions give to the sun, when he appears above their horizon after a few month's absence from it.

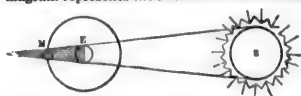
The crescent moon presents a singular appearance in the sky. It is popularly described as that of the new moon with the old one in her arms. It arises from the light reflected from the earth to the lunar surface, hence called earthshine, and *lunæ cœculus* by the French, or ashly light, on account of its inferiority in quantity and brightness, to that which is directly received from the sun. It only serves to render the unenlightened portion of

the moon very faintly visible; and the dark part of her body appears disproportionate to the size of the crescent, owing to the optical illusion which the presence of a strong light creates, that of apparently augmenting the magnitude of objects. When the moon is a crescent to us, the earth is about full to her, and, consequently, more light is then transmitted from the earth than in other circumstances, which has the effect of then bringing that portion of her disk, not exposed to the solar rays, into feeble visibility. The effect is not produced when the moon is half full, owing to the cause, for the reasons stated, being less influential. The satellite is the "waning moon" of popular speech during the gradual and regular diminution of the illuminated surface from the circle to the crescent shape, and the "waxing moon" through the interval of increase from the form of a thin crescent to that of a full round orb.

The moon is situated in external space at a mean distance of 237 thousand miles from the earth. Great as this interval is when compared with terrestrial extent, it is only about $\frac{1}{11}$ th part the earth's distance from the sun, and little more than one-fourth the diameter of the solar body. It is owing to this proximity to us, that she occupies so large a space in the heavens, for the lunar diameter is only 2160 miles. Our own globe is equal in magnitude to forty-nine such bodies, and the sun to near seventy millions.

There are two proper motions belonging to the moon, besides the annual pilgrimage around the great central orb accomplished in company with the earth. If her place with reference to a neighboring star on any clear night be ascertained, the next night she will be found to have moved about $15''$ farther eastward, and each night the distance will have widened, until from an opposite quarter of the heavens she will appear advancing towards the same proximity to the star. This proves her motion in an orbit around the earth; but great irregularities belong to it, which accurately to estimate is one of the most difficult problems and highest achievements of astronomy. The lunar tour through the heavens is accomplished in $29^d\ 12^h\ 45^m\ 11^s$ after which time, she returns to nearly the same position in relation to the stars. But the interval between one conjunction with the sun and another, or her synodical period, the lunar month, is $29^d\ 12^h\ 44^m\ 2^s$ because of her partnership in the orbital motion of the earth.

While, in the course of her monthly circuit, the moon passes between the sun and the earth, and deflects a shadow upon the latter, the complement is returned in another part of her orbit, by the earth's shadow being cast upon the face of the satellite. A lunar eclipse, as well as a solar one, would occur every month if the moon revolved in the same plane with the earth, but she escapes the terrestrial shadow owing to the inclination of her orbit 5° to the ecliptic, carrying her above or below it, and only suffers an eclipse, when, besides being in opposition to the sun, she is in or near the plane of the earth's path. The shadow of our globe is computed to extend 800,000 miles into space. It is long enough, therefore, to reach a body three times the distance of the moon. The diagram represents the immersion of the satellite in it. The lunar globe, however, when wholly immersed, is rather obscured than hid from view, owing to the inflexion of the rays of light to her orb from the terrestrial atmosphere. She appears frequently



of a dark copper color, because the red rays, which have the greatest momentum, are those which principally reach her.

Besides the orbital motion, there is another lunar movement, not so obvious, but plainly demonstrable. It is a well-known fact, that the same portion of the moon's surface, or nearly so, is always turned toward the earth. It necessarily follows, that during each revolution she must rotate upon herself, and accomplish one rotation in the time of one revolution. If we suppose an individual to walk around a tree, and to keep his face turned towards it, he will see completely around the horizon during his circuit, and will of course turn around upon himself. The alterations are slight as to the face which the moon presents to us in all her revolutions. On the eastern and western sides, and also on the northern and southern edges, small portions of disk alternately appear and disappear, as though the lunar globe oscillated and swung to and fro in space; and hence these appearances are termed librations, from *libra*, a balance, the former being in latitude, and the latter in longitude. There is, however, no real oscillation, but the orbital motion being irregular, while that on the axis is uniform, the effect is, alternately to extend and diminish the sides of the exhibited surface, as though an actual vibration of the whole body took place. These variations do not effect the correctness of the general statement, that the moon always shows the same face to us; and this is the consequence of the coincidence between the time in which she moves around the earth and rotates upon her axis.

It will be seen from the preceding statements, that though the moon is our near neighbor, and has been for ages a faithful companion orb, the acquaintance is very partial and reserved. Almost one-half of the satellite is perpetually turned from the earth, and to those regions that are thus concealed from us the earth is never visible. The lunarians, if such there are, inhabiting the districts beyond and opposite to the exhibited side of the moon, never catch a glimpse of the earth unless they travel into the hemisphere presented.

Whether the lunar globe has any gaseous covering, like that which supplies us with the breath of life, is a subject upon which there has been considerable conflict of opinion. One fact is clear, and is admitted by all parties, that if there be a lunar atmosphere, it is of extreme tenuity and exceedingly small, estimated by Schroeter to be little more than a mile in height. Hence, with such a medium, we cannot conceive of some of the grand phenomena with which we are familiar having any existence in the lunar world—such as the noise of many waters and of mighty thunderings—the voice of the passionate storm, or the mel-

ancholy wailing of the autumnal gales. No clouds are there, analogous to those which in ten thousand fantastic shapes are present with us, dropping fatness upon the fields, and casting shadows upon the landscape. No rain, hail or snow descends upon the lunar soil. It is difficult to imagine water at all, or any liquid, upon the surface; for if the atmospheric pressure were removed in relation to the earth, its liquids would be dissipated by the heat of the sun; and how much more might this result be expected at the surface of the moon, where the heat accumulated by its fifteen days' continuous exposure to the solar rays must be intense? There can be, therefore, no seas or lakes, or else evaporation would take place, and clouds be formed, perceptible through a telescope.

But though apart from the majestic features of the ocean, the tracts of cloud that float in our atmosphere, and the commotions that agitate it, the lunar surface exhibits several points of accordance with the terrestrial superficies. There are mountains answering in their contour to those which diversify our own globe, intermingled with plains, glens, and extensive depressions. To the naked eye, the face of the moon appears chequered, exhibiting dusky patches and bright parts, which, in former times, the ancients of men converted into images of terrestrial things. With the aid of a telescope, the lunar superficies presents an aspect that is excessively torn, ragged, and disturbed; and we are able to define peculiar physical features. Schroeter conjectured the existence of a great city on the east side of the orb, north of her equator, an extensive canal in another place, and fields of vegetation in another. Fraunhofer also announced the discovery of an edifice, resembling a fortification, together with several lines of road. The hope has likewise been entertained of discerning the dwellings and persons of the lunarians, should there be any; but these are visions, sanguine and baseless. Assuming, says M. Madler of Berlin, that a German mile is the utmost limit of distance at which the keenest unassisted eye can distinguish human beings, to bring the moon to that distance, a magnifying power of 51,000 would be necessary; but, up to the present time, 800 is the highest power which has been applied to that object with advantage. Alone therefore, upon this ground, those who indulge the imagination of studying any lunar samples of social and domestic economy, supposing it to be an inhabited world, are clinging to a forlorn hope.

The time when the moon's unevenness of surface may be most favorably seen, is when she is horned or gibbous. The boundary of the light and dark parts of the disk would obviously be an unindented line if the disk were perfectly plane, and had no surfaces higher than the rest. But look at the lunar crescent. The bounding line appears notched and broken, which is precisely the aspect that elevations and depressions will produce. Close by the edge of the illuminated portion, yet within the dark part, wholly surrounded with shade, there are small shining points, like islands of light in a sea of darkness. These are gradually joined to the luminous space, and become part and parcel of it, as the moon waxes. Here we have a clear indication of elevations. The portions of the dark part of the moon which thus stand out into the light are plainly



eminences, their summits catching the illumination of the sun's rays before the adjacent plains below, exactly as the summits of Mount Blanc is enlightened whilst the valley of Chamouni at its foot is in darkness. But we have farther evidence of the existence of lunar mountains and valleys. It is obtained from the fact that what are considered elevations project shadows in a direction opposite to that of the sun, while the depressions are dark on the side nearest to him, and illuminated on the opposite one. These shadows are observed to shorten as the sun's rays become more direct, and they proportionally lengthen as his beams fall more obliquely. This is so answerable to the phenomena which the action of sunlight upon hills and valleys will yield, and so consistent with what takes place on our own globe, as to place the conclusion of the moon's irregularity of surface beyond all doubt.

The dark and dusky patches apparent upon the moon's face, which remained constantly obscure, were supposed by the early observers to be seas, owing to water reflecting less light than land. Hence the names applied to them, as Mare Tranquillitatis, Mare Imbrium, and Oceanus Proceliarum, which are still retained. The supposition, however, of any quantity of fluid at the surface is plainly precluded by the fact of there being little or no atmosphere. These parts have all the appearance of being enormous spaces of lunar depression, their obscurity arising from being below the general level. They are not, however, depressed uniformly. The intermingling of light and dark shades, with the occurrence of districts as luminous as any portion of the lunar disk, indicate great superficial inequalities in these regions, apparently similar to what would be exhibited by the beds of the terrestrial oceans, if the waters were dissipated. Large spaces of depression would then be laid bare, but of very unequal depth, varying from a few fathoms to several miles. Are, then the vast lunar cavities intended to cradle a fluid element at some approaching epoch, or have they served that office, and by some physical change been deprived of it? Have the billows rolled and sported in their depths in by-gone time, or are they to come? These are queries which observed appearances naturally suggest, but we can grasp no certain conclusions. The aspect of the satellite is however thought to favor the idea that the surface has not yet been *water-worn*—that the present stage of its history is parallel to that of the earth, before the sharp asperities of its upheaved masses have been abraded by aqueous action, and smoothed by the detritus which it deposits. It is a striking peculiarity of these districts that they shine with various hues, from the gray tints

of the *Oceanus Procellarum* to the beautiful green of *Mare Tranquillitatis*, and the dark tracts of *Plato*. This diversity of color proceeds, probably, from some difference of substance; and to distant observers of our own world its chalk, red sand-stone, and granite formations may be supposed to present a similar diverse aspect, as well as the golden sands of Africa in contrast with the grey masses of the Alps, the white cliffs of England, and the green prairies of America.

The lunar mountains include several chains, the principle of which bears the name of the Apennines, a range running from north-east to south-west, in a straight line towards the centre of the disk, rising to the height of 20,000 feet. This altitude closely approaches that of the loftiest terrestrial mountains, though the diameter of the moon is little more than one fourth that of the earth. The chain may be seen casting long shadows over the *Mare Imbrium*, of which it forms the northern boundary, and from which the ascent is precipitous, while more gradual on the opposite side. Not only are the mountains higher, in proportion to the size of the moon, than those of the earth, but they are larger, much more numerous, and apparently of harder texture, projecting such sharp outlines, and overhanging in such a tremendous manner, as to lead many to the supposition, that the rocks composing them must be of a more solid nature than wrought iron.

But chains of mountains are exceptions in the lunar world. The prevailing arrangement is circular or crateriform, though without analogy, when closely examined, to the volcanic formations of our globe. The distinguishing circumstance is, that the areas enclosed are in almost every case depressed far below the general surface of the moon. These hollows in the lunar substance are surrounded with lofty ramparts, which often rise up with the steepness of vertice walls, and have of course their exterior height exceeded by that of the interior. They vary in magnitude from a diameter of not many yards to sixty and even more than a hundred miles; and are termed *holes*, *buttecks*, *plains* and *ring-mountains*, according to their size. The floors of these enclosed hollows are in some rare cases flat spaces, strewn with blocks; in a few instances they appear to be convex; but very frequently, one or more isolated peaks rise up from them, of a conical or sugar-loaf form, characterized with great abruptness and considerable elevation. When there is a central mountain of this kind in a large enclosure, its shadow is distinctly cast upon the floor, by which its shape can be ascertained, and its height measured trigonometrically. Many of the ring-mountains exhibit conspicuously a radiating aspect, streaks of light issuing from them like the rays of a lamp. The appearance is exactly like that exhibited by a piece of plate-glass struck with a stone. These radiations are comparable to the lava streams of our volcanoes in actual eruption, and were formerly considered to be such, but are most probably the illuminated summits of elevated ridges. No trace of active volcanic agency has hitherto been discovered in the moon; and the immense dimensions of its crateriform constructions have no analogy to anything on the earth.

The ring-mountain, *Eratothesius*, is one of the most remarkable of its class, standing at the northern extremity of the range. The interior plain is depressed 3,000 feet below the level of the outer surface, and as the bounding wall rises about the same height above it, the entire interior descent is 6,000 feet. The enclosed plain is not featureless. From the centre a huge mountain shoots up, at least 10,000 feet above the rim of the encircling rampart, so that its summits and sides are brightly lighted by the sunbeams long before its base, or any portion of the surrounding plain, has received a ray. Still more colossal are the dimensions of *Tycho*, an object with a radiating aspect, on the southern part of the lunar disk, plainly discernible by the naked eye at full moon. The enclosed area, which is nearly circular, has a diameter of 54 miles; and from its level, the enclosing ridge rises 17,000 feet with the steepness of a wall.

Occultations, repeatedly referred to in this chapter, are the apparent temporary extinction of planets and fixed stars by the moon in her monthly circuit, and phenomena parallel to eclipses of the sun. The lunar globe, in revolving around the earth, interposes in a direct line between us and the celestial bodies that lie in her path, and for a time appears to expunge them from the vault of heaven. Any of the planets may thus suffer an occultation by the moon, because they all move in nearly the same plane as the terrestrial and lunar orbit; but, obviously, only those fixed stars can ever be hid by the interposition of the lunar disk, which are situated at no greater distance from the ecliptic than the moon's extreme latitude. When the moon is crescent-shaped, and occults a star with the dark part of her body, it is apparently extinguished without visible cause; and if a bright object, the occurrence is striking and impressive.

Upon the subject of our lunar influence, we have no conclusion established by careful observation, beyond that of the moon being the chief agent in the rise and recession of the tides.

With reference to one province of the satellite, that of giving light to the earth, there can be no difference of opinion as to its utility, inferior as is the borrowed lunar to the direct solar illumination. The comparative proportion which the light of the moon bears to that of the sun is a problem to the solution of which the attention of several philosophers has been directed. The whole heavens covered with full moons would scarcely make daylight. From various experiments that have been made, it is supposed that the lunar light is only equal to the 800,000th part that of the sun; and, until very recently, its rays were believed to be without heat, as when collected by the aid of the most powerful glasses, no appreciable effect was produced upon the thermometer. But by concentrating them in a lens of three feet diameter, Melloni, the Italian philosopher, is said to have obtained a sensible elevation of temperature; and the same result has been gained by experimenting at a high altitude. In 1856, Professor Smyth conveyed a large collection of instruments for scientific purposes to the Peak of Tenerife, and made observations at two stations, respectively 8,340 and 10,700 feet above the sea. At both stations, the heat radiated

from the moon, so often sought for in vain in a lower region, was distinctly perceptible. But, vastly inferior as is the lunar to the solar light, its utility has been appreciated in all ages and countries by both rude and cultivated nations. To the Lunarians, if such there be, a similar service will be rendered by the earth, which, to those who occupy the presented hemisphere of the moon, will relieve with reflected light their fifteen days of darkness. The terrestrial world will exhibit to the lunar inhabitants all the phases which their dwelling presents to us, but upon a far more magnificent scale, for the earth will appear with a disk upwards of thirteen times larger than that which the satellite presents to ourselves. Its aspect will be perpetually changing by the rapid rotation upon its axis—its tracts of sea and continent being alternately presented; and provided with instrumental aid as powerful as that which we possess, a lunar dweller may discern various terrestrial phenomena—the mighty masses of cloud that are pendient in our atmosphere, the flashing lightning, the fields of ice at the poles, and the occasional outburst of volcanic fires.

CHAPTER VII.

MARS—PLANETODES—JUPITER—SATURN—URANUS—NEPTUNE.

EXTERIOR to our terrestrial world in the system, its noblest compeers are to be found. The planets technically called superior are known to lie out in space beyond the orbit of the earth. This is shown by several decisive proofs. They never appear crescent-shaped like Mercury and Venus, or exhibit any perceptible phase when viewed through a telescope, but are always seen with a full orb, with the exception of Mars, whose appearance is often gibbous. The inference is, that we see these planets in nearly the same direction in which the sun's rays enlighten them, and consequently the position of the earth must be comparatively proximate to the centre of their orbits. They are also never observed, when in the direction of the sun, to transit his disk, which would occasionally occur, if their path was interior to that of the earth, and carried them between us and the luminary. They are likewise seen at all distances from the sun, even in opposition, or in that quarter of the heavens which is diametrically opposite to the sun's place, rising in the east at sunset in the west, and being visible at midnight, which would plainly be impossible if the earth's orbit circumscribed theirs. These facts prove their position in the system to be exterior to our own. The external planets are chiefly distinguished from the internal by the attendance of secondary bodies, supplying in some degree to their primaries the place of the sun in his absence, and compensating for that diminution of his light when present, which arises from their vast distance from him. Mercury and Venus appear to have no moon, for, in connection with the earth, they answer the purpose of satellites to each other, Venus shining with great splendor in the night of Mercury, and our own globe forming a brilliant object in the night of Venus. At that point of the system in which we are placed, the scheme of primary and secondary bodies commences; and it distinguishes all the outlying planets to the farthest bounds of the solar universe. Mars, indeed, down to our own day, seemed to offer an exception to the rule, but is now known to be in harmony with it. The number of these secondary bodies appears to be proportioned to the wants of the primaries. While our globe has one, Mars, at a greater distance than the earth from the sun, has two; Jupiter, at five times the earth's distance, has four; Saturn, at nearly ten times the distance, has eight, besides the enormous rings, which afford an illumination equal to several thousand such attendants; and Uranus, at nearly twice the distance of Saturn, besides the four certainly known, may have hundreds that escape our notice, owing to the immense interval that separates him from us.

MARS, the nearest to us of the exterior planets, was, in former ages of superstition, the dread of the terrestrials on account of his fiery aspect, and ministered more than any other celestial object to give employment to the astrologers, and to fill their coffers:—

The planet is placed in the system at a mean distance from the sun of 149 millions of miles, hence upwards of fifty millions of miles farther than the earth. The space, however, between us and Mars varies prodigiously. When the two bodies are on the same side of the sun, they are five times nearer to each other than when on opposite sides, for then their distance is augmented by the entire diameter of the terrestrial orbit, or 183 millions of miles. On this account, the apparent size of the earth will vary greatly as seen from Mars, while Mars varies in appearance to us from a diameter of 18" to 4'.

The planet has been closely watched by many accurate observers, and his elements are known with considerable precision. Mars accomplishes his revolution around the sun in 686 $\frac{1}{2}$ 23 $\frac{1}{2}$ the length of his year, extending to nearly two of ours, traveling at the rate of 54 thousand miles an hour. In traversing the zodiac, he appears to move at the rate of about half a degree each day, passing through a whole sign in somewhat less than sixty days. Hence, if we know what constellation Mars has just entered, we may conclude that two months afterwards he will be in the next, and six months after the date in the succeeding one. His period of rotation upon his axis is 24 $\frac{39}{100}$ 21 $\frac{1}{2}$ but a slight difference in excess from the length of the terrestrial day. His true diameter is computed to be 4,100 miles, rather more than one-half that of our globe, and his volume is about one-fifth. His form is spheroidal, the diameter at the equator being one-sixteenth more than at the poles. From his period of rotation being so nearly equal to that of the earth, while his diameter is very little more than one-half, it might have been concluded that the inferior velocity of his equatorial regions would have produced a much less bulging out there than at the equator of the earth. But while the equatorial diameter of our globe exceeds the polar by twenty-six miles, that of Mars does so by two hundred and fifty, which gives a greater degree of oblateness to his form, and is probably due to his far inferior density. If the orbital career of the planet were suspended, his

mass would plunge to the sun in 151 days 10 hours. To Mars, the solar diameter will appear one-third less than to us, and the solar light and heat be proportionally diminished; but his night-sky will be adorned by our globe and its satellite, a beautiful pair of objects, about a quarter of a degree distant from each other.

The physical constitution of Mars is in many respects analogous to that of the earth. Indeed, the agreement between them is greater than between any two bodies in the system, as far as our knowledge extends. An atmosphere surrounds the planet. His ruddy complexion, observed in very ancient times, has been attributed to its density, and regarded as a phenomenon similar to the redness of our morning and evening sky near the horizon, which arises from the sun's rays passing through the densest part of our atmosphere at those periods. The red rays, having the greatest momentum, are those which chiefly make their way through the reflecting and absorbing medium. But recent examination of the spectrum of Mars sustains the opinion long ago expressed by Sir John Herschel, that the coloring really belongs to the substance of which the planet is composed, and thus corresponds to the tint of many of the clays, marls, and other soils which form so largely the superficies of the earth. When viewed through a telescope, the surface exhibits a variety of well-defined markings, some of which appear to be clouds and vapors floating in the atmosphere, as they are changing and evanescent. But others are permanent, and may be properly considered geographical features of the planet, its continents and oceans. So carefully has Mars been studied that we now possess charts of the entire surface with the position of different features determined by their latitude and longitude. They are also denoted for convenience of reference by the names of astronomers who have conspicuously contributed to their illustration. Small sharply-defined ellipses of white light appear around the planet's poles, conceived to indicate there the presence of accumulations of ice and snow, precisely parallel to the condition of our own polar regions.

There are thus points of striking accordance between the Martial and Terrene worlds. Their periods of light and darkness, night and day, are nearly equal. Both have a succession of seasons, arising from the obliquity of their respective ecliptics, though of different duration. Both have an atmosphere—clouds, rain, snow, continents and seas; but without an attendant moon, the oceans of Mars must be nearly tideless, only gently undulating like the waters of the Mediterranean and the Baltic. Each planet has also vast fields of ice and snow at its poles. Should the inhabitants of Mars take a view of our world through any far-seeing instrument like that with which we inspect their dwelling, the terrestrial aspect, viewed from that distance, in one of its phases will not be very remote from the sketch now given.

Proceeding farther on an outward-bound course through the system, we arrive at the cluster of diminutive bodies, whose existence is a modern discovery. They present a variety of anomalies which distinguish them from the older planets; and received from Herschel the distinctive appellation of Asteroids, a Greek compound signifying the appearance of stars, but by others they are more properly called Planetoids, or small planets. Of these bodies, four were discovered early in the century, Ceres, Pallas, Juno, and Vesta, as the result of a search conducted upon the presumption that some unknown orb lurked in the vast space between Mars and Jupiter. The first three are exclusively telescopic objects, and require the best instruments to be caught. But Vesta shines with a very intense light, as a brilliant point in the heavens, and has been observed on a clear evening by the naked eye. Following the order of succession in the system, Vesta is at the mean distance of 225 millions of miles from the sun, Juno 254, Ceres and Pallas 263. Their periods of revolution range from somewhat more than 8½ to 4½ years. The orbit of Juno is remarkable for its eccentricity, being so elliptical that the greatest distance of this minute world from the sun is nearly double the least. Both Ceres and Pallas appear to be surrounded with a nebulous haze.

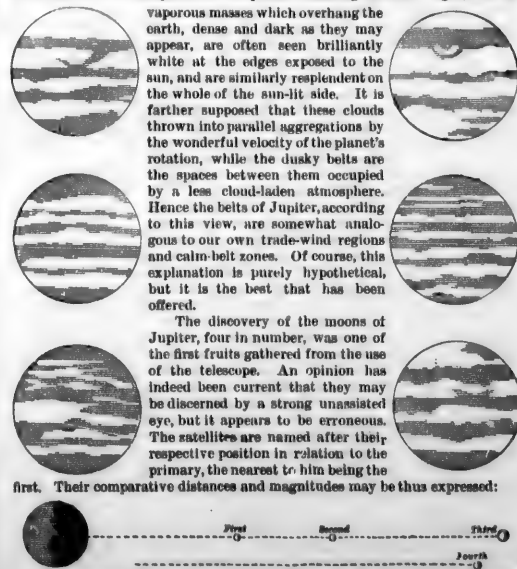
There are several peculiarities belonging to these bodies. Though their dimensions are not known with precision, they are all very exceptionally minute, even when compared with the least of the secondary members of the system. Indeed, the superficial area of some of them is not greater than that of many a terrestrial estate. Their diameters are supposed to range from 230 miles to much below 50 miles. They deviate also considerably from the path the heavens described by the other planets, so much so, that the zodiac must be expanded to more than twice its breadth in order to include their orbits. Their mean distances from the sun likewise differ very slightly, while the orbits intersect one another—the most remarkable feature of their condition.

JUPITER, the next in succession after the telescopic planets, is the noblest member of the solar family in his dimensions, and the brightest in his appearance, with the exception of Venus, whom, however, he rivals in splendor, although more than seven times her distance from the sun. His mean distance from the central body is 476 millions of miles. His entire path in space extends over about 8,000 millions of miles, an orbit accomplished in nearly twelve years, at a mean rate of twenty-nine thousand miles an hour. Jupiter travels over 4° 30' 33" of the zodiac in a day, somewhat less than one-twelfth of a degree, or 30' 20' 33" in a year, rather more than a sign. His course in the heavens may therefore be very easily traced. In whatever constellation he is seen on a certain night, a year hence he will be seen equally advanced in the next, and two years afterwards in the

next. Jupiter occupies but 90° 55' 40" in his axial rotation. Thus, in the time in which we have one day and night, he has two, each about five hours long, the sun by day and the stars by night, with his own moons, apparently flying across his heavens more than twice as fast as the celestial bodies appear to traverse ours. By this rapid spinning upon his axis, his equatorial inhabitants will be carried around at the rate of 35,000 miles an hour, which is farther than the equatorial inhabitants of the earth are carried by its diurnal motion in twenty-four times that period. Of the stately dimensions of this fine planet, some idea may be formed from the statement, that a chain extending from the earth to the moon would not compass the equatorial circumference; and that, supposing a sailing vessel to accomplish the circumnavigation of our globe in a year, it would require upwards of ten years to perform at the same rate a similar voyage around Jupiter. His diameter is nearly ninety thousand miles, eleven times that of the earth, and its volume is thirteen hundred times greater. But as his density is about one-fourth that of the earth, but little exceeding that of water, the quantity of matter in that vast orb is only 331 times greater than what our globe contains. In two years and thirty-five days it would descend upon the sun, if left to the influence of his attraction.

From the immense velocity of the equatorial regions of Jupiter, and the intensity of the centrifugal force, a considerable deviation in his figure from a perfect sphere is to be expected. This is open to observation. The form of the planet, even on a careless view through a good telescope, appears that of an oblate spheroid. That change of season which we experience is a diversity unknown to this planet. This arises from the axis being perpendicular, or nearly so, to the plane of the orbit, so that the days and nights are constantly of equal length, and the direction of the sun's rays constantly uniform, oblique towards the poles, and perpendicular at the equator. We have here undoubtedly another instance of wise arrangement, for otherwise the regions towards the poles would have been alternately immersed in the darkness of a six years' wintry night. It is not, however, to be understood that one uniform season prevails over the surface, but that the same parallels of latitude north and south of the equator enjoy uniformly the same season, whatever that season may be. It is perpetual summer in the equatorial regions, and perpetual winter at the poles; but the rapid rotation of the planet is a security against intense heat accumulating in the former through the invariably direct action of the solar rays, and against the intensity of cold that would prevail at the latter, if their influence was absent for any considerable interval.

Jupiter, when viewed through a telescope, exhibits a series of zones, or bands, familiarly called belts, stretching across his surface in a direction parallel to his equator, and, generally, to each other. These belts are variable both in number and breadth. Sometimes eight have been seen, sometimes only one, but more usually three. Instead of being uniformly regular in their shape, they have frequently a lacerated appearance, and, while some continue in the same form for months, others change in a few hours. These appearances open a wide field for speculation. The belts have been deemed attentions upon the surface of the planet caused by great physical convulsions. A far more probable and generally received opinion is, that the bright bands are compact strata of clouds in the atmosphere of the planet reflecting the solar light, for the

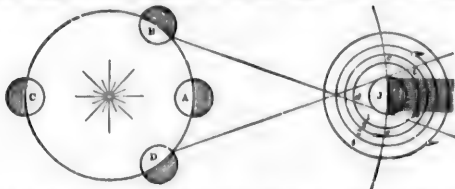


first. Their comparative distances and magnitudes may be thus expressed:

The largest of these bodies is thus the third in point of distance; the next in magnitude is the fourth; the third in magnitude is the first; and the smallest is the second, being rather less than our own moon. It is in striking accordance with the case of our satellite, that the moons of Jupiter always turn the

same face towards him, and thus make one rotation upon their axes while accomplishing one orbital revolution. These attendants are obviously designed to give him a splendid night in compensation for a day less lustrous than that which we enjoy; and it deserves notice that their orbital motions are so arranged that they can never be all new moons, and consequently invisible, at the same time. The position of the satellites with respect to each other, and to their primary, as seen from the earth, is very variable. Sometimes they appear ranged in a line on each side of the planet; at other times they are all grouped on the same side.

All the satellites are eclipsed once in every revolution by passing through the shadow of the planet, with the exception of the fourth, which sometimes escapes, because of the greater magnitude and inclination of its orbit. But with reference to the first satellite, it is never the case that both the immersion and the emersion can be observed, owing to its being so near the planet, and this is generally true of the second. On the other hand, the satellites pass between Jupiter and the sun in their revolution around him, and then project their shadows upon the enlightened portion of his disk, causing a solar eclipse to that part of his surface. They pass also between the planet and the earth, and then exhibit the phenomena of transit; and, lastly, they pass directly behind the body of the planet in opposition, and are then occulted. At A B C D the earth is represented in different parts of its orbit; and at J Jupiter is seen surrounded by his four satellites, whose orbits are marked 1, 2, 3, 4. The first satellite is shown entering the shadow of the planet at a; b is the point of emergence from it; and clearly, the interposing body of the planet will prevent the emersion from being visible to a spectator on the earth at A, who sees the immersion,



and that will be invisible from the same cause to a terrestrial observer at A, who sees the emergence. The satellite at c and d has its greatest eastern and western elongations to a spectator on the earth at A; and it appears projected as a small dark spot upon the disk of Jupiter at d.

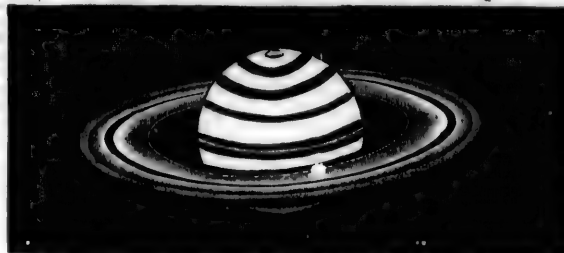
The laws which govern the planets in their revolution around the sun, govern the satellites in their revolution around their centre. They move in elliptical orbits, and, like the larger bodies, travel in a direction from west to east. Though insignificant in point of magnitude when compared with their primary, their united bulk is equal to thirteen of our moons. The first satellite will be a conspicuous object in the Jovian firmament, while, to it, the great planet will be exhibited on a scale of inconceivable magnificence, presenting every forty-two hours the varying forms of a crescent, a half and full moon, and a gibbous shape, appearing a thousand times larger than our moon appears to us in her corresponding phases.

SATURN.—From the nobles of the planets in point of magnitude, we pass to the most extraordinary in architecture—an orb which would exhibit the most fascinating appearance to the eye but for its remoteness. An interval of space, closely corresponding to the vast chasm between Jupiter and the sun, must be crossed to arrive at Saturn, whose mean distance from the solar orb is nearly nine hundred millions of miles, and who never hails the terrestrials from any station nearer than eight hundred millions. He occupies a period of 10,759 solar days in accomplishing his circuit around the sun, having a mean daily motion among the stars of only about 2', the thirtieth part of a degree. If observed therefore entering a particular constellation of the zodiac, we may conclude that a period of two years and a half will elapse before he will bid it farewell. The year of the planet, extending to nearly thirty of ours, gives an age to his octogenarians, should there be any, parallel to that of a terrestrial born when the Jews were in Babylon, and surviving to be one of our contemporaries. His day is rather longer than that of Jupiter, but shorter by more than one half than our own, as he rotates upon his axis in 10^h 30^m. While appearing to the naked eye as a pale feeble point in the heavens, the Saturnian orb has an actual equatorial diameter of 71,604 miles, and a volume which is nine hundred times greater than that of the earth. Owing to his far removal from the central source of light and heat, his surface receives only the ninetieth part of these elements compared with that we enjoy; but it is computed, that even the ninetieth part of the solar light exceeds the illuminating power of three thousand of our moons at the full, and would itself be amply sufficient for the purposes of life. If arrested in his orbital course, and abandoned to the force of the solar attraction, Saturn would drop to the sun in about five years and two months. Though not so swift upon his axis as Jupiter, the two diam-

eters exhibit a greater difference, the polar being 6,700 miles shorter, than the equatorial, a degree of oblateness due to the greater lightness of his material in connection with his axial speed. It was formerly supposed that the diameter is not the greatest at the equator, but at some distance from it, and that the north pole region is much more flattened than the south. But the real shape is that of an exact spheroid of considerable ellipticity.

Men had long been upon terms of acquaintance and familiarity with Saturn without suspecting the grandeur of his construction, or the remarkable apparatus with which he is furnished. The shepherd astronomers of Chaldean—the star-gazers of Egypt, Greece, and Rome—the astrologers of the middle ages—Copernicus and Tycho Brahe—saw the planet only as a dull æbulous star slowly moving through the heavens. It was not until the earth had performed its annual circuit around the sun many thousand times, that the stately form and numerous attendants of the remote wanderer—hitherto deemed obscure and dreary—were revealed.

The planet is now more fully known to us. It occupies an illustrious place in the system, having a train of eight moons, with two conspicuous rings encompassing its body—a peculiarity of structure without another example in



the universe, so far as we are acquainted with it. The two rings are readily seen in good telescopes separated by a dark interval. But recently, using mightier instrumental power, the discovery has been made of a *third*, inside the other two, which seems to be composed of a substance altogether different. It is of a dusky aspect, and semi-transparent, as the ball of the planet can be seen through it. It has also been ascertained that there is a delicate subdivision of the outer ring, visible only near the extremities. The planet is not exactly central with reference to the annuli, but a little to the west, a position

which is found to contribute to the stability of the Saturnian system. The surface of the globe exhibits belts, bright and dark, which point to the same cause as similar phenomena in the case of Jupiter, whatever that cause may be. But, unlike his neighbor, the axis of Saturn is inclined 29° to the plane of his orbit. He has days and nights therefore of unequal length, a diversity of seasons, and alternately for years continued winter and darkness reign at his poles.

The satellites of Saturn have been named by Sir John Herschel, beginning with the innermost, Mimas, Enceladus, Tethys, Dione, Rhea,

Titan, Hyperion, and Iapetus, after the Titanian divinities. Their respective distances from their primary vary from about half the distance of our own moon to upwards of two millions of miles. Their periodic revolutions also vary from twenty-two hours to seventy days. Little is known as to their precise magnitude, but the most distant is evidently the largest, and is supposed to be nearly equal to Mars in size. The first discovered, or the sixth as to distance, called in honor of the discoverer, Huygenian satellite, is the brightest. These two may be discerned with ordinary optical aid. The rest are more difficult objects, and it requires the mightiest telescope to reach those, which just skirt the rings, discovered by Sir W. Herschel.

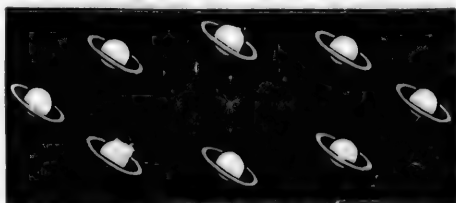
The dimensions of the two conspicuous rings, as given from the measurements of Struve, made at Dorpat in the year 1838, with Fraunhofer's large refractor, do not differ to any important extent from later determinations. They are as follows:—

Exterior diameter of Exterior ring	- - -	179,418 miles
Interior diameter of exterior ring	- - -	155,273 —
Exterior diameter of interior ring	- - -	151,690 —
Interior diameter of interior ring	- - -	117,339 —
Interval between the inner ring and Saturn	- - -	19,000 —
Interval between the rings	- - -	1,791 —
Thickness of the rings not more than	- - -	100 —

The above measurements give to the exterior ring a width of 10,573 miles, and to the interior of 17,175 miles, making the entire width of the bright rings including the interval, 29,538 miles. That these appendages are opaque substances is shown by the fact that they throw shadows on those parts of the planet that are on a line with them and the sun, and on the other hand they

receive the shadow of the planet. Both these rings have a motion of rotation, accomplished in $10^h 30^m 17^s$ a condition plainly essential to their stability, the centrifugal force engendered by the rotary motion balancing the attraction of the planet, and preventing their precipitation to its surface.

The planet is here shown in different parts of its vast circuit around the sun, with the earth in corresponding orbital positions. As the rings maintain the same inclination to the plane of the orbit, it is obvious at a glance that their aspect to a terrestrial observer must greatly vary, in the course of revolution. Alternately one side is seen and then the other, and oval forms of dif-



ferent ellipticity are presented. It also happens that the earth being in the plane of the rings, or in a direct line between them and the sun, only the edge is turned to us, about a hundred miles thick. They are then invisible, except with the aid of the mightiest telescopic power, when a fine line appears drawn across the disk of the planet, projecting on each side. This occurs twice in each revolution, or once in every fifteen years. These are the phases of Saturn, exhibited in the side views, phenomena which astonished Galileo, and which Huygens was the first to explain. The appearance in the centre represents Saturn and his rings as he would be seen if placed perpendicularly above us.



Phases of Saturn.

The annular apparatus of Saturn illustrates the diversities of the system, and in connection with his moons is no doubt intended to give him compensation for a scanty supply of direct solar light. Three of the satellites are nearer to him than our moon to us, and the other four will be conspicuous objects in the heavens of the planet. The nearest satellite probably presents a disk equal in extent to nine or ten times that of our lunar globe; and flying around its primary every twenty-two hours, a rapid succession of phases will be exhibited. In an age of imperfect telescopes the perplexity of the early observers respecting the constitution of the Saturnian system was very natural. It is amusing now to read the records of it, yet highly encouraging to contrast our own knowledge of the planet with their surmises, as it illustrates the success with which the persistent application of greater instrumental power to a once completely baffling object has been crowned.

URANUS.—This remote and obscure body, removed to about twice the distance of Saturn from the sun, may be seen with the naked eye by a practiced observer in fine weather when the moon is absent, and appears like a fixed star of the least visible magnitude, shining with a pale blue light. The planet is situated at a mean distance from the sun of 1,800 millions of miles, and has a path of more than 10,000 millions to traverse in revolution around him, accomplished in a period of eighty-four years. It moves over one degree of its orbit in eighty-five days, and is thus seven years in passing one constellation of the zodiac. Uranus, apparently insignificant in the heavens, is the fourth of the planets in magnitude, seventy-four times larger than the earth in volume, having a diameter of 33,000 miles. Six satellites, according to the discoverer, attend his course. They revolve in orbits, the planes of which are nearly perpendicular to the ecliptic, and in a direction from east to west—singular anomalies—exceptions to the general laws of the system. All the other primary planets and the satellites move from west to east, and the satellites move nearly in the same plane with the orbits of their primaries. Why these laws should be departed from in this instance is an inexplicable circumstance. As we know little of Mercury owing to his proximity to the sun, so we know little of Uranus owing to his remoteness. The proportion of light and heat which reaches him is about $\frac{1}{100}$ th that which the earth receives, but this is equal to the illuminating power of several hundreds of our full moons. From his far distant sphere, the planet would fall if subject alone to the centripetal force, and require an interval of nearly fifteen years to be precipitated upon the sun.

The last discovered and farthest planet is at the enormous distance of 2,800 millions of miles from the sun, and marks the present boundary of the planetary system. Neptune has a diameter of 36,500 miles, a period of revolution of 164 years, and is certainly attended by at least one satellite, first seen by Mr. Lassell, in 1846.

A cursory view has now been taken of the individual members of the solar system. The vastness of its area and the magnitude of its objects forcibly arrest attention. The more, indeed, we become experimentalists in the scenery of the universe, the more impressed we are with the imperfection of all human thought and language in relation to its range, the dimensions of its structures, and conscious of the inadequacy of our conceptions. In early life we form ideas of magnitude which are notoriously defective. To childhood romping upon the village green the scene of its gambols presents an extensive surface, and the hill-side appears a considerable elevation;—the experience of after years corrects these impressions. When the man returns to the scenes of his youth, after having been long separated from them, he is surprised at their altered aspect, and struck with the fallacy of his former views. The green of the village seems but a span, and the eminence a hillock. After having gazed upon the expanse of the Amazon, or the powerful current of the Mississippi, the stream meandering through the meadows which once suggested an idea of amplitude, inspires only a notion of insignificance. It is thus with us when the mind departs from terrestrial regions, and studies the outlying realms of nature. The survey corrects and expands its views. The fallacy of former conceptions of height, length, breadth, and depth is felt, and, penetrating into space, the conviction becomes more distinct, at every step, of the poverty of language to express, and the inadequacy of intelligence to grasp, the real magnitude of the universe.

The superficial extent of the earth includes upwards of a hundred and ninety-seven millions of square miles, and its solid contents amount to two hundred and sixty thousand millions of cubic miles. Huge as this bulk is, it is but like a hillock to Mont Blanc, when contrasted with Jupiter, Saturn, or Uranus.

The mind can only imperfectly embrace the vastness of planetary territory; yet it is but as a province to an empire when compared with a single object. In the system—the sun. The solar surface comprises an area of nearly $9\frac{1}{2}$ billions of square miles, the planetary surface being in proportion to it as $\frac{1}{100}$ th and the terrestrial surface as $\frac{1}{10,000}$ th. In its solid bulk, the solar globe is equal to five hundred times the volume of the planets, and to nearly $1\frac{1}{4}$ million such worlds as ours.

The extent of space occupied by the orbits of the planets is no less astonishing than the stateliness of some of their dimensions. At the railroad speed of fifty miles an hour, an individual would accomplish the journey over the longest tract of land in the old world, from the coast of Senegal to that of Kamtschatka, in ten days. But it would require a period of 430 years to proceed in a direct line from one extremity of the earth's orbit to another at the same rate of motion; and this is but a trifling span when compared with the dimensions of some of the other planetary orbits. If a vehicle had been set in motion at the commencement of the Christian era, and had incessantly kept up the velocity mentioned, it would not yet have performed half its passage across the orbit of Saturn; or if one had begun a similar pilgrimage at the same rate across the orbit of Uranus when Adam was in paradise, it would yet be far away from its goal. Suppose an inch employed to represent the earth's distance of 91 millions of miles from the centre of the system, 10 inches will be required to express the proportionate distance of Uranus, and 30 inches that of Neptune, its visible boundary. Views of extensiveness thus break in upon us which are perfectly inappreciable and confounding. Of a mile, or ten miles, or a hundred miles, we can form a distinct conception, because these are spaces which we often travel over; and a person who has sailed across the Atlantic will be able to entertain a commensurate idea of one, two, or three thousand miles. But when millions are brought before us, we have an extent to grapple with, which so far transcends that of the scenes of terrestrial locomotion as to defy our mental grasp to embrace the distance. The area occupied by the system to which we belong is thus stupendous. To form a conception of its amplitude worthy of it, is at present beyond the scope of our faculties. Yet our further inquiries will show this area to be but a small department of the creation, as small, when compared with the visible regions of the universe, as a few yards of rock peeping up above the surface of the waves to the broad expanse of the Pacific!

The relative distances of the planets from the central source of light and heat exhibit great discrepancies. Taking that of the earth as 1, the proportionate distance of Mercury is $\frac{1}{5}$, Venus $\frac{1}{4}$, Mars $\frac{1}{4}$, Jupiter $\frac{5}{4}$, Saturn $\frac{9}{4}$, Uranus 10, Neptune 20. This diversity of position must produce diverse physical effects; but even to the farthest planet the Sun is still a Sun, and will afford an illumination several hundred times surpassing our largest supply of lunar light. The apparent diameter of the sun, as seen from the earth, is $33'$. As seen from the other planets it will be,

Mercury	Venus	Mars	Jupiter	Saturn	Uranus	Neptune
$80'$	$46'$	$21'$	$6'$	$3'$	$1\frac{1}{2}'$	$30''$

The comparative size of the solar orb from these several stations may be thus pictorially expressed



To express the proportionate volume of the sun, a circle with nearly a diameter of one foot would be required. The following illustration of the

relations of the sun and his attendants is taken from Sir John Herschel and Dr. Nichol. If we conceive the sun to be a globe two feet in diameter, then a *grain of mustard seed*, at eighty-two feet distance, will represent the size and place of Mercury. A *pen*, at the distance of one hundred and forty-two feet, will be the similitude of Venus; and another, slightly larger, at two hundred and fifteen feet, will be the appropriate representative of the earth.

A good *pin's head*, removed three hundred and twenty-seven feet from the central globe, will stand for Mars; and a few of the smallest *grains of sand*, placed at the distance of five hundred feet, will denote the Asteroids. An *orange* of moderate size, distant a quarter of a mile, will indicate Jupiter. Saturn may be shown by a *lemon* one, at two-fifths of a mile; and Uranus by a *cherry*, at three quarters of a mile.

There are remarkable differences as to the material of the solar and planetary orbs. Their weight, compared with that of the earth taken as 1, is,

Sun	Mercury	Venus	Mars	Jupiter	Saturn	Uranus	Neptune
855,000	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{10}$

Their weight, compared with that of a globe of water of the same size, is estimated to be

Sun	Mercury	Venus	Mars	Jupiter	Saturn	Uranus	Neptune
11-5	17-5	81-5	81-5	1-5	1-5	1-5	1-5

What striking diversities! While our planet, weighed in the balance against an equal volume of water, is five times heavier, the matter of Mercury is three times heavier still, while that of Saturn has only half the density of the fluid. If cast therefore upon an ocean capacious enough to receive them, Mercury would sink with as great a momentum as a globe of lead, while Saturn would be buoyant as a vessel of wood upon the deep. Upon the magnitude and density of the planetary spheroids, the force of gravity or the weight of bodies at their surface depends. Hence, though the solar altitude is so much less dense than that of the earth, yet, owing to its vast bulk, a man weighing 140 pounds at the terrestrial equator would weigh more than 3,500 at the surface of the sun. Jupiter is still less dense, but on account of his superior

magnitude the force of gravity at his surface is eight times as great as at the earth's, so that a terrestrial inhabitant transported thither would be burdened with eight times his present weight, would move with eight times the difficulty, and would fall with eight times the force.

In regarding the planetary worlds as the abodes of sentient life and of forms of existence kindred to those which occupy the earth, but endlessly diversified, we are far in advance of all sensible evidence, but not beyond what the soberies of reason will justify. It may be hard to imagine how life can be sustained under the apparent heat of Mercury, or amid the seeming cold, the tremendous storms, and rapid atmospheric changes of Jupiter. But, ignorant of facts, a parallel difficulty would be a stumbling-block to us, in relation to our own planet, when we consider the high temperature of its equatorial regions and the intense cold of its polar circles. All the planets are plainly of one family as to their physical character, their general configuration, their motions of revolution and rotation, and the alternation of day and night; and these are resemblances which may reasonably lead us to suspect other analogies. The fact is also clear, of Mercury, Venus, Mars, Jupiter, and Saturn being surrounded with atmospheres;—a constitution which strongly indicates their occupancy with some varieties of organized being. We know, in the case of our own globe, the important uses of its atmosphere in maintaining animal life, transmitting sound and light, and in advancing the arts which tend to civilize society. We may well believe, therefore, that it has been furnished with this elastic and essential apparatus, in order to adapt it for the reception of animal existence and intelligent inhabitants; and the inference is just, that a similar arrangement distinguishing other planets, points to the same destination. It is a possible conception,—but we should smile at the credulity of the man who believed it real,—that a fleet of ships navigating the ocean, with sails untied and pennons flying, did so without a cargo in the hold, a crew on board, or an object in view.

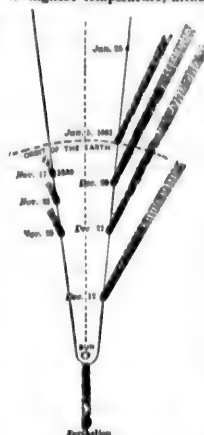
CHAPTER VIII. COMETS.

Of all the celestial objects which have arrested the attention of mankind, none have excited such general and lively apprehension as those upon the consideration of which we now enter. Their general features are a definite point or nucleus—a nebulous light surrounding the nucleus, and a luminous train proceeding or following it.

There are several plain points of difference between comets and planets. The planets move in the same direction from west to east, which is astronomically called direct motion; but the movements of comets are often from east to west, or retrograde. The orbits of all the planets are confined to a zone of no great breadth on either side of the ecliptic; but the paths of comets cut the ecliptic in every direction, some being even perpendicular to it, traversing the heavens in all parts. The contrast is striking likewise between the forms of their respective orbits. A hoop will with no great inaccuracy represent the courses of the planets, but cometary paths are of every possible eccentricity, both elongated ellipses and open curves, as parabolas or hyperbolas. Only one end of the ellipse lies within the limits of the system, in the case of the great

majority of comets with shut orbits. They only visit our gaze therefore during one part of their course, and that a very small part, traveling during the rest of their journey far beyond the range of the most distant planet, into spaces inaccessible to our sight. Those which describe parabolas and hyperbolas are casual visitors only; and depart to return no more. Planetary configuration is also uniformly globular, but the external appearances of comets exhibit great diversities of form, from that of an irregular wisp of cloud to a simple spherical luminosity, or a strongly-defined scimitar-shaped aspect.

The diagram represents the path of one of the long-periodic comets in 1880, but only a very small part of it, which was described in little more than two months, while the perihelion time is supposed to be not less than five hundred years. The direction of the luminous train or tail is shown, the frequent attendant of cometary bodies. This is nearly always away from the sun, frequently assuming a curved form. It increases in length with its proximity to the solar body, but does not acquire its greatest extent until after the perihelion or the point nearest to the sun is passed. If we regard the train as vaporization produced by the intense heat to which the body of the comet is exposed upon approaching the sun, this accounts for its increasing length and greatest extent after the perihelion, just as it is after the summer solstice that the earth attains its highest temperature, although its daily supply of solar influence is then actually diminishing. The comet appears in the diagram at its perihelion passage merely for the sake of illustration, as in that part of its course it was completely lost in the solar blaze.



The comet of 1066 is conceived on good grounds to have been identical with that of 1092. Its first recorded appearance was thus immediately prior to the Danish invasion of England, and during the declining days of the empire of the caliphs. The second visit, which must have been about 1092, in the reign of the Conqueror, is unrecorded; and the third and fourth, in 1155 and 1230, are merely mentioned by the annalists, without any detail. Its fifth return was in the year 1265, when the papal chair was removed to Avignon, the Swiss cantons were effecting their independence, and Edward I. tyrannising over Scotland. At the season of Easter, this "great and fearful star," as it was called, was perceived, but so far from raising the temperature, a supposed cometary effect in later times, a general cold prevailed over Europe, and a severe frost in England at Midsummer destroyed the corn and fruits. History gives no particulars of its next visit in 1390, but in 1456 its appearance filled all Christendom with consternation. It passed very near to the earth, and swept the heavens with a tail extending over sixty degrees, in the form of a sword or sabre. The Turks had just become masters of Constantinople, and threatened an advance into the heart of Europe. The comet variously excited hope and fear, according



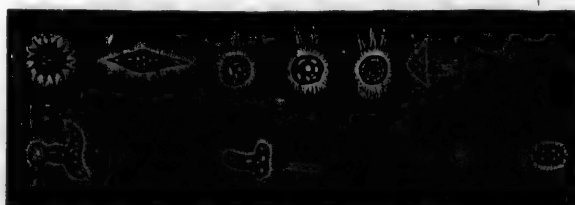
as it was deemed the friend of the crescent or the cross. At Constantinople, the occurrence of a coincident lunar eclipse increased the portentousness of the event. Phranza, grand-chamberlain and principal secretary to the last head of the Greek Roman empire, reports:—"Each night, soon after sunset, a comet was seen like a straight sabre, approaching the moon. The night of the full moon having arrived, and then by chance an eclipse having taken place, according to the regular process and circular orbits of the celestial lights, as is customary—some persons seeing the darkness of the eclipse, and regarding the comet in form of a long sword which arose from the west, and traveled towards the east, approaching the moon, thought that the comet in shape of a long sword thus designated, with regard to the darkness of the moon, that the Christians, inhabitants of the West, had agreed to march against the Turks, and would gain the victory. At the eighth return in 1531, the New World had been discovered. The comet as then seen in Cancer was of a bright, gold color. In 1607, the ninth visit, the Copernican system had been broached, and Galileo and Kepler were laboring to establish it. The course of the comet was observed through Ursa Major, Boles, Serpens, and Ophiuchus. Its light was pale and watery. The tail is described as long and thick, like a flaming lance or sword. The apparent magnitude of the head was greater than that of any of the fixed stars or Jupiter. The tenth return brings us to the time of Newton and Halley. Cassini calls



it then as clear and round as Jupiter, referring to the nucleus. At the eleventh revolution in 1759, it was a pale and feeble object. Messier was obliged to use a powerful reflecting telescope. Palitzel, indeed, caught it with the naked eye once, but no one else appears to have done so. In 1835 the twelfth advent, it was much more distinct, and was frequently seen without a telescope presenting the annexed appearance.

Its thirteenth return will occur in 1911, and will be witnessed by many of the present generation.

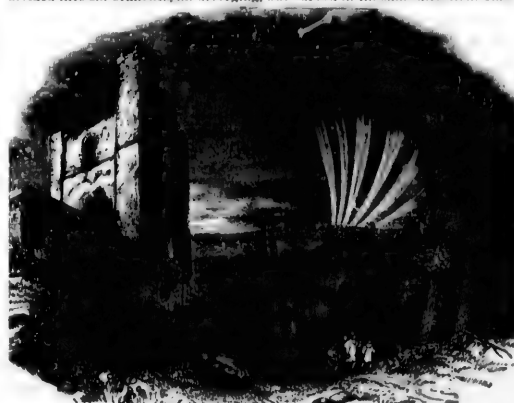
The later apparitions of Halley's comet have thus been far less brilliant and conspicuous than its earlier exhibitions. Arago conjectured that the comets, in describing their immense orbits, disseminate in space at each revolution all the matter which when near the perihelion is detached from the nucleus and forms the tail. It is clearly possible, therefore, that some of them may in process of time completely waste away, unless by traveling through similar detached trains, they recover a quantity of matter sufficient to compensate for their own losses. We may believe, then, that dissipation occurring, the same body that now presents an insignificant appearance, exhibited a bolder



front in days of yore, though the early annalists and artists have undoubtedly borrowed largely from imagination in describing these bodies. In a celestial

atlas published about the year 1680 several drawings of comets occur "from which the preceding are selected. It is evident that these artistic efforts are not true to nature, however true to such wild and distorted descriptions as the following, from the "Exempla Cometarum" of Rosenburg, a contemporary of Newton:—"In the year 1527, about four in the morning, not only in the Palatinate of the Rhine, but nearly over all Europe, appeared for an hour and a quarter a most horrible comet, in this sort. In its length it was of a bloody color, inclining to saffron. From the top of its train appeared a bended arm, in the hand whereof was a huge sword in the instant posture of striking. At the point of the sword was a star. From the star proceeded dusky rays, like javelins or lesser swords, as if imbrued in blood, between which appeared human faces of the color of blackish clouds, with rough hair and beards. All these moved with such terrible sparkling and brightness, that many spectators swooned with fear."

The next most remarkable comet of modern times appeared about the middle of December, 1743, and continued visible during the spring of the year following. On the 1st of February, according to Chizeaux, it was more brilliant than Sirius, the brightest star in the heavens. On the 8th it equaled Jupiter and was visible in the presence of the sun at the beginning of the next month. By selecting a convenient situation many persons saw it at mid-day without glasses. Several instances of similar brilliancy are on record. Sassin mentions a comet which appeared at the birth of Mithridates, and overcame the brightness of the sun by its splendor; and, however this may be an exaggeration, there are many well attested cases of these bodies being seen by broad daylight. The Casarian comet, two others in 1492, with one in 1680, were thus visible. The fine comet of 1677 was seen with the naked eye by Tycho Brahe before sunset. On account of its brightness and peculiar form the comet of 1744 excited great attention and interest. It exhibited no train until within the distance of the orbit of Mars from the sun; but, early in March, it appeared with a tail divided into six branches, all diverging, but curved in the same direction. Each

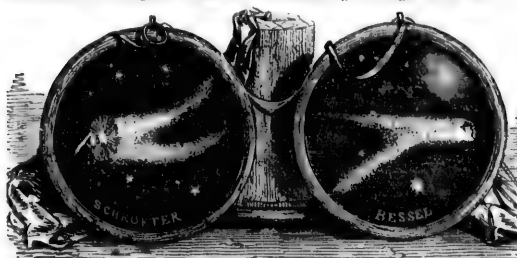


of these tails was about 4° in width, and from 30° to 44° in length. The edges were bright and decided, the middle faint, and the intervening spaces as sombre as the rest of the firmament, the stars shining in the background. This comet was repeatedly seen in Switzerland, with the nucleus below the horizon, and the six tails extending from twenty to thirty degrees above it. The scene presented by this remarkable body in the situation referred to was striking in the extreme when circumstances favored the display.

In the year 1770 a comet appeared which has acquired considerable notoriety from the alterations which its orbits have undergone. Its elements were calculated by Lexel, who found for its orbit around the sun an ellipse of which the transverse diameter was only equal to three times the diameter of the earth's orbit, which corresponded with a period of revolution of five years and a half. It was deemed a singular circumstance that an object having so short a periodic time, whose greatest distance from the sun was not far beyond the orbit of Jupiter, and which shone with a vivid light, should not have been observed before; and the wits of the day made themselves merry, when, at the expiration of the appointed term, the comet was not observed to return. It has not been seen since; and was popularly called Lexel's lost comet. But this sport was premature. The previous invisibility and subsequent disappearance of this body, after once presenting itself, have been sufficiently explained; and a confirmation of the laws of universal attraction has been drawn from circumstances apparently adverse to them. Its previous invisibility is accounted for by its orbit being altogether different prior to the year 1770, its nearest point to the sun being as distant as the path of Jupiter, corresponding, not to five, but to fifty years of revolution. Its appearance that year arose out of the fact that in 1767 it was in such close contact with the planet, moving in the same direction and in nearly the same plane, that the attraction of the sun upon it was not less than that of Jupiter. This entirely altered the form of the orbit, and caused the comet to wheel its path towards that of the earth, coming within our view, and executing the ellipse described by Lexel in the periodic time of five and a half years. But why has not the comet since been seen? Its passage to the point of

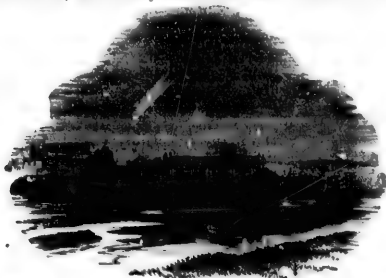
perihelion in 1776 took place by day; and in 1779, before another return, it again encountered the vast body of Jupiter, and suffered a fresh orbital derangement, the attraction of the planet deflecting it into more distant regions. The comet, therefore, though "lost" to us, is in existence, and in each instance of its change of route has faithfully obeyed the laws of gravitation. Those laws in 1770 introduced it as a bright and beautiful stranger to the notice of the human race, and again in 1779 stopped the fellowship, removing the comet into a remoter path, where it is hid from the gaze of man, and will be so unless some new perturbation directs its course towards the terrestrial orbit.

Another comet, exhibiting some remarkable features, presented itself in the year 1807. It was assiduously observed by Herschel in this country, and by the continental astronomers, Schroeter, Bessel, and Olbers. The drawings of the two former are here given, taken on two succeeding evenings, which show a



divided tail, the separate branches having varied their aspects. Comets, flickering and vanishing like the northern lights, appeared to shoot out in an instant from the train to an immense extent.

In the autumn of 1811, by far the finest comet suddenly appeared to adorn our heavens, that had been seen since the age of Newton. It was first beheld in this country in the beginning of September, and was visible for more than three months in succession to the naked eye, shining with great splendor, the observed of all observers. This was a comet of the first class in point of magnitude and luminosity. Its brilliant tail, at its greatest elongation, had an extent of 123 millions of miles, by a breadth of 15 millions; and thus, supposing the nucleus of the comet to have been placed on the sun, and the tail in the plane of the orbits of the planets, it would have reached over those of Mercury, Venus, the Earth, and had bordered on that of Mars. At its nearest approach to us, the comet was yet distant 141 millions of miles, so that even had the tail pointed to the earth, its extremity would have been 18 millions of miles away



from its surface. The appearance of this comet was strikingly ornamental to the evening sky. Many a reaper late in the harvest field stayed his hand, and many a peasant homeward-bound stopped in the way, to gaze upon the celestial novelty as it grew into distinctness with the declining day.

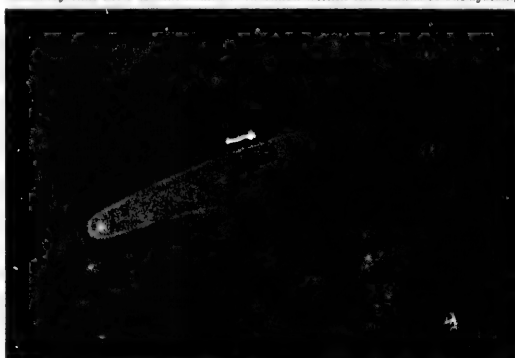
The year 1811 was very remarkable for its high temperature—the bountiful harvest—the richness and abundance of the vintage. Popular opinion assigned these blessings to the resplendent comet; and the wine of the comet was sold afterwards at high prices. No doubt, however, that precisely different circumstances would have been connected, by the public mind, with the same cause; and this has literally been the case, for "a cold winter," and "meteors in Germany," are referred to the comet of 1680, by a writer in 1839.

No conclusion can be drawn, to the effect that cometary appearances have any influence in raising the temperature. In 1826 and in 1831 no comets presented themselves, and the temperature was nearly at its maximum. In 1808 there were four, and it was nearly at its minimum.

There was no inconsiderable amount of superstitious fear blended upon this occasion with the natural feelings of wonder and admiration that were excited. As the great comet of 1680 had been deemed a manifest preface of the revocation of the edict of Nantes, the persecution of the French protestants, and the long wars that ensued, so was the beautiful and transient visitor of 1811 abused in a similar manner. It was wily regarded as the herald of some awful terrestrial occurrence, and the particular event intended was not doubtful to many minds when Napoleon led his legions from the West to perish amid the snows of Russia, and Moscow was in flames!

Science has been more recently occupied with comets of short periods, insignificant in their external aspect, but deeply interesting on account of the

discovery that their orbital course is included within the bounds of our system,

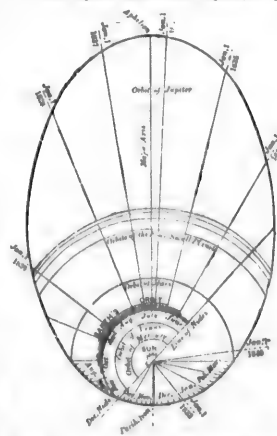


and their predicted returns fulfilled. Some of those whose elements have been determined are here inserted:

Names.	Years of Revolution	Greatest distance from the sun.	Nearest approach to the sun.
Encke's Comet	5.25	387,000,000 miles	28,000,000 miles.
Biela's "	6 1/2	385,000,000 "	88,000,000 "
De Vico's "	8 1/2	475,000,000 "	110,000,000 "
Brorsen's "	11 1/2	557,000,000 "	84,000,000 "
D'Arrest's "	12 1/2	600,000,000 "	192,000,000 "
Faye's "	17 1/2	805,000,000 "	

The first of these objects has now frequently answered to the announcements made respecting its course, incontestably establishing its character as a regular member of our system, moving in obedience to its laws. The comet appears as a small globular patch of vapor, without any starlike nucleus or tail, scarcely perceptible, and its dimness to be increasing. But this insignificant and shadowy thing exhibits a deeply interesting and important phenomenon, that of the gradual diminution of its periodic time, owing to a decrease in the size of its orbit, the supposed effect of a resisting medium in space, which is urging it nearer the sun, and may ultimately terminate its career as a separate body. The same conclusion is entertained with reference to the planets, founded upon this peculiarity of the comet of Encke. If the space in which they move is occupied by a resisting medium, that, it is conceived, will, in the long run of ages, diminish their velocity, decrease the centrifugal force, give more power to the solar attraction, draw them towards the centre, and thus end the system. Such a speculation is, to say the least, premature. We may admit the existence of an ethereal medium which shall perceptibly affect the movements of light vaporous bodies, yet offer no appreciable opposition to the solid and weighty planetary masses. The proper course is to wait until such a medium is placed beyond all doubt, for it cannot be said yet to be demonstrated; and until we have some evidence of its action in the case of the planets, before we reason upon it as a fact.

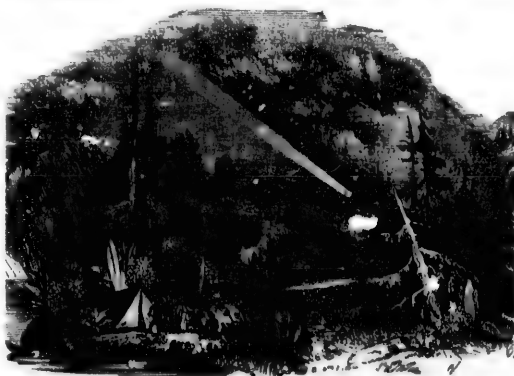
Biela's comet, discovered by an Austrian officer of that name in Bohemia, in the year 1826, was first seen as a round nebulous body in the constellation of Aries; and was soon perceived to correspond in its path to that of the comets of 1772 and 1807, with which it was subsequently identified. Its aphelion place is a little beyond the orbit of Jupiter, its perihelion within that of Venus, its



time of revolution 2461 days, or 6 1/2 years. This was the comet which excited a large amount of apprehension for the safety of our terrestrial mansion, prior to its return in 1832. It was calculated that a little before midnight, on the 29th of October, it would cross the plane in which the earth revolves, near the point where our globe itself would be on the morning of the 30th of November following; and undoubtedly, had the comet been delayed a month by any disturbance, a collision with its nebulousity would have taken place. But the earth's progress in its orbit being at the mean rate of two millions of miles daily, and a month intervening between the passage of the comet across it and the arrival of the earth at the same point, the two bodies were never nearer than sixty millions of miles. The accompanying diagram represents its course as compared with that of the earth. On the ellipse are marked its places for the beginning of each year, from 1833 to 1840. Biela's comet, on the occasion of its third re-appearance, in 1840, underwent a singular transformation. It separated into two distinct bodies, which continued to travel through the whole period of visibility.

In the spring of 1843 the world was suddenly startled by the apparition of an object in the western heavens, soon after sunset, like a streak of aurora, streaming from the region of the sun below the constellation Orion. By many observers it was mistaken at first for the zodiacal light; but its aspect and movements proved it to be a comet of the very largest class. The nucleus was not seen here, but it was visible in more southern latitudes, where the whole appearance of the comet was far more definite than with us. The phenomenon was observed at Nice on the 12th of March; at Oporto on the 14th; and at Paris on the 17th. It was like a narrow thin cloud, one end being apparently merged in the remaining solar light, and the other in or near the constellation Lepus. Instead of being luminous at the edges, and more obscure in the middle, a general characteristic of cometary tails, which has induced the belief that they are cones internally empty, the light of the tail, in the present instance, was very more intense in the centre than on the sides. This was one of the largest comets ever observed. Its train must have extended through celestial space to the enormous length of a hundred and sixty millions of miles. It was traveling with prodigious velocity away from the sun, having doubled the solar orb upon first becoming visible, and soon vanished from terrestrial gaze in the immensities of the universe. In south Africa its appearance was very distinct.

A European, traveling in the wilds of America, the only representative of the civilized world present upon the occasion, has graphically narrated his own impressions, and those of his Indian companions:—"We were ascending the Essequibo river. The weather was unfavorable, and the sky had been covered with clouds for weeks. We were approaching the cataract Ourupocari in 4° 11' north latitude, and had encamped, on the 8th of March, three miles below it, when, for the first time since our departure from the coast, the sky, hitherto a uniform mass of greyish clouds, cleared in the evening, and exposed, towards south-west, the deep tropical blue, spangled with stars. We hailed with pleasure the prediction of better weather; but what was our amazement when we observed, in the W. S. W., a broad, white, nebulous band, inclining towards the horizon. The zenith was covered with those beautiful clouds which the meteorologists call cirro-cumulus; the sky was, however, perfectly clear on both sides of the band which, 64' (in arc) broad, and of a pure white, almost transparent, formed a strong contrast with the deep azure of the tropical sky. I could not observe whether the band rested apparently on the horizon, as the wall-like forest, near the edge of which we were encamped, prevented me from seeing that portion of the sky. From the point where the band became visible it appeared of a uniform breadth, becoming more transparent, and slightly diverging, near the summit. What can it be? was the first question. My Indian friends stood around, looking now with wonder at the phenomenon, now askance at me. Our doubts were solved next evening, March 9: it was a comet. Our camp was so favorably situated that the south-western horizon was exposed to our view. The sky was partially clouded until seven o'clock, when the clouds to the west cleared away, and there stood the comet in all its grandeur, the nucleus being about 12° above the horizon, and the tail extending to the star Eridani, then about 45° high. The nucleus appeared, to the naked eye, like a star of the second magnitude; its tail, near the base like a narrow band, spread in its broadest part 1° 10', and lost itself in the constellation Eridani. We stood amazed. A bright moon somewhat lessened the effect which this most wonderful of all natural phenomena would have produced had all else been hidden in darkness; but the extent of the tail rendered it remarkable: indeed, it was the largest which we, who stood assembled, had ever witnessed in our lifetime.



This comet is remarkable on various accounts. It advanced nearer to the solar surface than any other on record. That of 1680 approached the sun within one-third of his diameter; but that of 1843 came within one-seventh, and was consequently more than twice as near, exposed to a heat of proportionate greater intensity. Sir John Herschel computed that the heat received by its surface during the passage of the perihelion was equal to that which would be received by an equal portion of the earth's surface, if it were exposed to the influence of 47,000 suns, placed at the common distance of the actual sun. It is difficult to conceive how a flimsy body could have resisted such a temperature so as not to have been entirely dissipated. This comet is also remarkable as one of the few

on record which have been visible in broad daylight. At noon, on the 28th of February, it was distinctly seen without the aid of glasses, by numerous persons congregated in the streets of Bologna, in Italy.

Among the comets of splendid appearance, a reference is due to Donati's, upon which the eyes of millions rested with wonder and delight, after the sunset hour had passed, during the summer months of the year 1858. The tail was an object of matchless beauty, expanding over a breadth of 90,000 miles, and covering the bright star Arcturus, but without losing it from view, or dimming its light. It is now known that these brilliant comets are very few when compared with the whole number which actually approach the earth, for scarcely a year passes without one, two, or even more being discovered by the telescope.

The strangely fantastic conformations which these bodies undergo in their approach to perihelion and recession from it, sometimes breaking up into two or more separate parts, are evidently due to the solar action, in whatever way it may be exercised. The annexed cut represents some of the various appearances presented by Halley's comet in 1835 in different parts of its orbit—a, b, c, in approaching the sun; d, e, in retreating.



Cometary astronomy has hitherto advanced but little in knowledge respecting the physical constitution of its objects, beyond the fact that they are self-luminous and most likely entirely gaseous. But armed with the spectroscopic, it may be confidently anticipated, that obscure points relative to their structure will be made clear, whenever a brilliant and long-tailed member of the family appears. One thing is very certain, that while through century after century they have been visible at intervals in the terrestrial sky, the existing order of nature has never been interfered with by their action, though repeatedly disturbed themselves by proximity to other bodies in the system.

In the case of Lexell's lost comet intruding into the system of Jupiter without affecting the satellites, but being itself deflected into a new path by the venture, may lead us to look without alarm upon a similar approach being made to fellowship with ourselves. No trifling service has been rendered to mankind by science, in having divested these bodies of those attributes of terror with which they were identified in ages past, when regarded as the heralds of political misfortune, or threatening fatal physical events. It is no slight advantage to the moderns, that they can gaze upon such objects without anticipating disaster, and regard them as controlled by those laws to which their own world is obedient.

CHAPTER IX.

METEORS—AEROLITES—METEORIC SHOWERS.

From every region of the globe, and in all ages of time within the range of history, exhibitions of apparent instability in the heavens have been observed, when the curtains of the evening have been drawn. Suddenly, a line of light arrests the eye, darting like an arrow through a varying extent of space, and in a moment the firmament is as sombre as before. The appearance is exactly that of a star falling from its sphere, and hence the popular title of shooting star applied to it. The apparent magnitude of these lights aloft sensibly differs, and also their brilliancy. Occasionally, they are far more resplendent than the brightest of the planets, and throw a very perceptible illumination upon the path of the observer. A second or two commonly suffices for the individual display, but in some instances it has lasted several minutes. In every climate it is witnessed, and at all times of the year, but most frequently in the autumnal months. Various hypothesis have been framed to explain the nature and origin of these remarkable appearances. When electricity began to be understood, this was thought to afford a satisfactory explanation, and the shooting stars were regarded by Beccaria and Vassall as merely electrical sparks. When the inflammable nature of the gases became known, Lavoisier and Volta supposed an accumulation of hydrogen in the higher regions of the atmosphere, because of its inferior density giving rise by ignition to the meteoric exhibitions. While these theories of the older philosophers have been shown to be untenable, there is still great obscurity resting upon the question, though we have reason to refer the phenomena to a cause exterior to the bounds of our atmosphere. Upon this ground, the subject assumes a strictly astronomical aspect, and claims a place in a treatise on the economy of the solar system.

The first attempt academically to investigate these elegant meteors was made by two university students, afterwards Professors Brandes and Leipzig, and Benzenberg of Dusseldorf, in the year 1786. They selected a base line of 46,300 feet, somewhat less than nine English miles, and placed themselves at its extremities on appointed nights, for the purpose of ascertaining their average altitude and velocity. These points have since been carefully examined by Prof. Heis of Münster, the Padre Secchi at Rome, and others, with the general result, that shooting-stars appear at the average height of seventy-two miles, and disappear at the height of fifty-two miles. Their average velocity is given at about thirty-four miles per second, which is twice as great as that of our planet in its orbit. These objects are differently colored. By far the largest number are white. Next in frequency are yellow stars, in the proportion of

about one yellow to five white. Others exhibit orange, green, blue, and red tints. It has been remarked, that more stars are seen after than before midnight, while they are more frequent in the months from July to December than in those from January to June. But within and near the tropics shooting-stars appear in greater profusion, with far more brilliancy than in our northerly latitude, not from any real superiority in their number, but owing to the purity and transparency of the atmosphere in tropical regions.

The rush of luminous bodies through the sky of a more extraordinary kind, though a rare occurrence, has repeatedly been observed. They are usually discriminated from shooting-stars, and known by the vulgar as fire-balls; but probably both proceed from the same cause, and are identical phenomena. They have sometimes been seen of large volume, giving an intense light, a hissing noise accompanying their progress, and a loud explosion attending their termination. In the year 1676, a meteor passed over Italy about two hours after sunset, upon which Montanari wrote a treatise. It came over the Adriatic Sea as if from Dalmatia, crossed the country in the direction of Rimini and Leghorn, a loud report being heard at the latter place, and disappeared upon the sea towards Corsica. A similar visitor was witnessed all over England in 1718, and forms the subject of one of Halley's papers to the Royal Society. It was computed to have passed over three hundred geographical miles in a minute, at the distance of sixty miles above the surface, and was observed at different extremities of the kingdom. The sound of an explosion was heard through Devon and Cornwall, and along the opposite coast of Bretagne. These magnificent objects are denominated *detonating meteors*. They do not in general travel so directly or rapidly as shooting-stars, but frequently appear to have an impulsive motion leading them to follow a waved or contorted path. A meteor of this class passed over the state of New Jersey, November 15, 1859, which was visible in the full sunlight, and was followed by a series of terrific explosions which were compared to the discharge of a thousand cannons. In detonating meteors those solid bodies have their origin which descend to the surface of the earth, are variously stony or metallic in their substance, and are now to be met with in the museums of all nations, objects of interest and curiosity as of extra-terrestrial birth.

Antiquity refers us to several objects as having descended from the skies, the gifts of the immortal gods. Such was the Palladium of Troy, the image of the goddess of Ephesus, and the sacred shield of Numa. The folly of the ancients in believing such narrations has often been the subject of remark. But, however fabulous the particular cases referred to, the moderns have been compelled to renounce their scepticism respecting the fact itself. A few undoubted examples may be given out of many hundreds which have occurred in modern times:

Date.	Place.	Description.
1492, Nov. 7.	Enselheim, in Alsace.	A large stone, weighing 320 lbs.
1510.	Near Padua, in Italy.	About 1800 stones, one of 150 lbs., another of 60 lbs.
1667, Nov. 27.	On Mount Vaucluse, Provence.	A stone weighing 26 lbs.—fall observed by Cassendi.
1731, May 26.	Agram, in Croatia.	Two masses of metallic iron, one of 77 lbs.
1790, July 24.	Near Agen, in France.	An extensive shower of stones.
1798, Dec. 15.	Wold Cottage, Yorkshire.	A stone of 66 lbs.
1798, Dec. 15.	Near Banure, India.	Shower of stones.
1806, April 21.	Near L'Aigle, in Normandy.	3000 stones fell, intensely heated; one person wounded.
1812, May 21.	Between Vienna and Prague.	200 stones fell.
1823, June 15.	Juvenas, Ardèche, France.	Fall of stones—fragment of one in the British Museum.
1833, July 30.	In Tennessee, U. S.	Fall of iron.
1845, Sep. 16.	Near Muhlhausen.	Large aerolite fell—sky clear.
1848, January.	Corrientes, in Brazil.	Mass of iron several feet in diameter.
1850, Nov. 16.	Near Brescia, in Lombardy.	Aerolite weighing 17 lbs.
1857, October 1.	Des. of Young, in Brazil.	Shower of stones.
1860, May 1.	In Ohio, U. S.	Shower with violent detonations—total weight of aerolites, 700 lbs.
1864, May 14.	Orquell, in France.	Shower of stones.
1866, June 9.	Kuyukina, in Hungary.	Aerolite fell, weighing 6 cwt.—thousands of smaller size.

The following are the principal facts with reference to the aerolites, upon which general dependence may be placed. If examined immediately after their descent, they have always a temperature more or less elevated. They are almost invariably invested with a peculiar thin crust, consisting chiefly of oxide of iron, often of pitted lustre, very distinctly defined from the interior mass. What is most remarkable, in the great majority of cases, their chemical analysis develops the same substances combined in nearly the same proportions, though one may have reached the earth in India, another in England, and a third in America. Not more than twenty primary ingredients at the utmost have been noticed in them. But some of the best known consist almost entirely of one ingredient, iron, with a small proportion of nickel. Others contain cobalt, manganese, chromium, copper, tin, arsenic, associated with a small per-centage of oxygen, sulphur, and chlorine. Others consist principally of silica and metallic oxides. It should be distinctly noted, that the iron and nickel are almost always in the metallic form—a state in which they are not found naturally on the surface of the earth. It is also to be observed, that though a chemical examination of their composition has disclosed no substance with which we were not previously acquainted, yet not only are the majority of terrestrial elements wanting, but while non-metallic ingredients occur in the largest quantities in terrestrial nature, they occur in aerolites in much smaller quantities than the metals. Their ingredients are earthly in their kind; but while many important terrene elements are absent, those that are present are not mingled in earthly proportions. Neither products of our volcanoes, whether active or extinct, nor the stratified or unstratified rocks, exhibit any example of chemical combination similar to that of the meteoric masses. Thus they differ immensely from things terrestrial, as to the number and proportion of their constituents. One non-metallic substance alone, oxygen, is computed to form a third of the weight of the crust of the earth; and oxygen appears feebly in these remarkable objects.

In addition to aerolites, properly so called, or bodies known to have come to us from outlying space, large metallic masses exist in various parts of the world, lying in insulated situations, far remote from the abodes of civilization, whose chemical composition is precisely similar to that of the substances descent of which has been witnessed. These circumstances leave no doubt as to their common origin. Pallas discovered an immense mass of malleable iron, mixed with nickel, at a considerable elevation on a mountain of slate in Siberia, a site plainly irreconcilable with the supposition of art having been there with its forges, even had it possessed the character of the common iron. In one of the rooms of the British Museum there is a specimen of a large mass which was found, and still remains, on the plain of Otumba, in the district of Buenos Ayres. The specimen alone weighs 1,400 lbs., and the weight of the whole mass, which lies half buried in the ground, is computed to be thirteen tons. In the province of Bahia, in Brazil, another block has been discovered weighing upwards of six tons. Considering the situation of these masses, with the details of their chemical analysis, the presumption is clearly warranted that they owe their origin to the same causes that have formed and projected the aerolites to the surface. With reference to the Siberian iron a general tradition prevails among the Tartars that it formerly descended from the heavens.

A multitude of theories have been devised to account for the origin of these remarkable bodies. The idea is completely inadmissible that they are concretions formed within the limits of the atmosphere. The ingredients that enter into their composition have never been discovered in it, and the air has been analyzed at the sea level and on the tops of high mountains. Even supposing that to have been the case, the enormous volume of atmospheric air so charged required to furnish the particles of a mass of several tons, not to say many masses, is alone sufficient to refute the notion. They cannot, either, be projectiles from terrestrial volcanoes, because coincident volcanic activity has not been observed, and aerolites descend thousands of miles apart from the nearest volcano, and their substances are discordant with any known volcanic product. Terzago suggested their projection from lunar volcanoes. It has been calculated that a projectile leaving the lunar surface, where there is no atmospheric resistance, with a velocity of 7771 feet in the first second, would be carried beyond the point where the forces of the earth and moon are equal, would be detached, therefore, from the satellite, and come so far within the sphere of the earth's attraction as necessarily to fall to it. But the enormous number of ignited bodies that have been visible, the shooting stars of all ages, and the periodical meteoric showers that have astonished the moderns, render this hypothesis untenable, for the moon, ere this, must have become sensibly impaired, while no trace of an active volcano has yet been discovered on her surface.

These theories have now been completely set aside in favor of planetary hypothesis, which originated about half a century ago with Chladni, a German, and slowly made its way to universal acceptance. He conceived the system to include an immense number of small bodies, either the scattered fragments of a larger mass, or original accumulations of matter, which, circulating around the sun, encounter the earth in its orbit, and are drawn towards it by attraction, become ignited upon entering the atmosphere, in consequence of their velocity, and constitute the shooting stars, aerolites, and meteoric appearances that are observed. Sir Humphry Davy, in a paper which contains his researches on flame, strongly expresses an opinion that the meteorites are solid bodies moving in space, and that the heat produced by the compression of the most rarefied air from the velocity of their motion must be sufficient to ignite their mass so that they are fused on entering the atmosphere. It is estimated that a body moving through our atmosphere with the velocity of one mile in a second, would extricate heat equal to 30,000° of Fahrenheit—a heat more intense than that of the fiercest artificial furnace that ever glowed. The chief modification given to the Chladnian theory has arisen from the observed periodical occurrence of meteoric shower—a brilliant and astonishing exhibition—to some notice of which we proceed.

The writers of the middle ages report the occurrence of the stars falling from heaven in resplendent showers among the physical appearances of their time. The experience of modern days establishes the substantial truth of such relations, however once rejected as the inventions of men delighting in the marvelous. Conde, in his history of the dominion of the Arabs, states, referring to the month of October in the year 909 of our era, that on the night of the death of King Ibrahim ben Ahmed, an infinite number of falling stars were seen to spread themselves like rain over the heavens from right to left, and this year was afterwards called the year of stars. In some Eastern annals of Cairo, it is related that "In this year (1029 of our era) in the month Rejeb (August) many stars passed, with a great noise, and brilliant light;" and in another place the same document states:—"In the year 599, on Saturday night, in the last Moharrem (1202 of our era, and on the 19th of October), the stars appeared like waves upon the sky, towards the east and west; they flew about like grasshoppers, and were dispersed from left to right; this lasted till day-break; the people were alarmed. The researches of the Orientalist, M. Von Hammer, have brought these singular accounts to light. Theophrastus, one of the Byzantine historians, records, that in November of the year 472 the sky appeared to be on fire over the city of Constantinople with the concussions of flying meteors. The chronicles of the West agree with those of the East in reporting such phenomena. A remarkable display was observed on the 4th of April 1005 both in France and England. The stars seemed, says one, "falling like a shower of rain from heaven upon the earth;" and in another case, a bystander, having noted the spot where an aerolite fell, "cast water upon it, which was raised in steam, with a great noise of boiling." The chronicle of Rheims describes the appearance, as if all the stars in heaven were driven, like dust, before the wind.

The first grand phenomenon of a meteoric shower which attracted attention in modern times was witnessed by the Moravian Missionaries at their

ASTRONOMY.—SCENERY OF THE HEAVENS.

settlements in Greenland. For several hours the hemisphere presented a magnificent and astonishing spectacle, that of fiery particles, thick as hail, crowding the concave of the sky, as though some magazine of combustion in celestial



space was discharging its contents towards the earth. This was observed over a wide extent of Territory. Humboldt, then traveling in South America, thus speaks of it:—"Towards the morning of the 13th of November, 1799, we witnessed a most extraordinary scene of shooting meteors. Thousands of bolides and falling stars succeeded each other during four hours. Their direction was very regular from north to south. From the beginning of the phenomenon there was not a space in the firmament equal in extent to three diameters of the moon which was not filled every instant with bolides and shooting-stars. The meteors left luminous traces or phosphorescent bands behind them, which lasted seven or eight seconds." The Capuchin missionaries at San Fernando, a village amid the savannas of the province of Varinas; and the Franciscan monks stationed near the entrance of the Orinoco, also observed this shower of asteroids, which appears to have been visible, more or less, over an area of several thousand miles, from Greenland to the equator, and from the lonely deserts of South America to Weimar in Germany. About thirty years previous, at the city of Quito, a similar event occurred. So great a number of falling stars were seen in a part of the sky above the volcano of Cayamburo, that the mountain itself was thought at first to be on fire. The sight lasted more than an hour. The people assembled in the plain of Exhla, where a magnificent view presented itself of the highest summits of the Cordilleras. A procession was already on the point of setting out from the convent of Saint Francis, when it was perceived that the blaze on the horizon was caused by fiery meteors, which ran along the sky in all directions, at the altitude of twelve or thirteen degrees. In Canada, in the years 1814 and 1819, the stellar showers were noticed, and in the autumn of 1818 on the North Sea, when, in the language of one of the observers, the surrounding atmosphere seemed enveloped in one expansive ocean of fire, exhibiting the appearance of another Moscow in flames. In the former case, a residuum of dust was deposited upon the surface of the waters, on the roofs of buildings, and on other objects. The deposition of particles of matter of a ruddy color has frequently followed the descent of aerolites; and may explain popular stories of the sky having rained blood. The next exhibition upon a great scale of the falling stars occurred on the 13th of November, 1831, and was seen off the coasts of Spain. This was followed by another in the ensuing year at exactly the same time.

By far the most splendid display on record, was included within the limits



of the longitude of 61° in the Atlantic Ocean, and that of 100° in Central Mexico, and from the North American lakes to the West Indies. Over this wide area, an appearance presented itself, far surpassing in grandeur the most imposing artificial fire works. An incessant play of dazzlingly brilliant luminosities was kept up in the heavens for several hours. Some of these were of considerable magnitude and peculiar form. One of large size remained for some time almost stationary in the zenith, over the falls of Niagara, emitting streams of light. The wild dash of the waters, as contrasted with the fiery uppour above them, formed a scene of unequalled sublimity. In many districts, the mass of the population were terror-struck, and the more enlightened were awed at contemplating so vivid a picture of the Apocalyptic image—that of the stars of heaven falling to the earth.

This extraordinary spectacle commenced a little before midnight, and reached its height between four and six o'clock in the morning. The night was remarkably fine. Not a cloud obscured the firmament. Upon attentive observation, the materials of the shower were found to exhibit three distinct varieties:—1. Phosphoric lines formed one class apparently described by a point. These were the most abundant. They passed along the sky with immense

velocity, as numerous as the flakes of a sharp snow-storm. 2. Large fire-balls formed another constituency of the scene. These darted forth at intervals



along the arch of the sky, describing an arc of 30° or 40° in a few seconds. Luminous trains marked their path, which remained in view for a number of minutes, and in some cases for half an hour or more. The trains were commonly white, but the various prismatic colors occasionally appeared, vividly and beautifully displayed. Some of these fire-balls, or shooting-stars, were of enormous size. Dr. Smith of North Carolina, observed one which appeared larger than the full moon at the horizon. "I was startled," he remarks, "by the splendid light in which the surrounding scene was exhibited, rendering even small objects quite visible." The same, or a similar luminous body, seen at New Haven, passed off in a north-west direction, and exploded near the star Capella. 3. Another class consisted of luminosities of irregular form, which remained nearly stationary for a considerable time, like the one that gleamed aloft over the Niagara Falls. An observer at Boston estimated the number of meteors at 10,000 for every quarter of an hour, making a total of 280,000 for the seven hours of the memorable night. Yet not a single pellet that could be identified as of celestial origin seems to have reached the ground, and no residuum or deposit of dust was anywhere perceptible, though it must have been sown broadcast by the winds upon the surface.

The problem offered for solution by the remarkable phenomena described, however apparently irresolvable, was vigorously attacked by eminent men of science in America and Europe, and with the most signal success. The annual occurrence of meteors in November, sometimes more, sometimes less, but in unusual abundance on a rule, with grand showers at the epoch after considerable intervals of intermission, were the first facts decisively established. Next, it was shown by Professor Newton, of Yale College, after making allowance for difference of style, that the resplendent exhibitions on historic record accommodate themselves to a cycle of 33½ years; and hence he boldly predicted a return of the display of maximum intensity for the morning of the 14th of November 1866. This announcement, sustained by the opinion of many astronomers as a highly probable forecast, naturally excited great interest, especially as the period approached when its accuracy would be tested.

The night of Tuesday, the 13th of November 1866, was generally favorable to star-gazing, the sky being at times without a cloud, particularly in the neighborhood of the metropolis, though the wind blew strong, gusty and cold. By half-past ten o'clock the irregular group of stars forming the constellation Leo was well up from the horizon, and clear of its haze. But the *Leonides* as yet made no sign, and the eye turned anxiously but in vain to the east, as men look at a fortress that will not reply to a challenge. Occasional meteors at length put in an appearance, gliding swiftly along the sky from east to west, as *arabesques* of the great legion soon to follow. They increased rapidly towards midnight, when it seemed as if a celestial rocket battery had been opened in Leo, where the radiant region was most strikingly manifested.

A very large number were as bright as the first-magnitude stars Vega and Sirius; several equaled Jupiter in size; and some were comparable to Venus in her greatest splendor. One of the most singular and striking features of the grand sight was when several of the meteors ran parallel to each other, as if racing, with colors varying from white to blue, red and purple. Now they flew towards Capella; or passing Procyon, aimed at Betelgeuse and Rigel; or darted direct to the Great Bear, proceeding by the pointers to the zenith. Almost without exception the meteors left glittering trains behind them, marking the course they had traversed, which, in the case of those of the larger class, were of surpassing beauty, being of a vividly green hue, and strikingly phosphorescent in appearance. The great majority were white, with a yellowish tinge; many were red and orange; a few were blue.

What know we of these glittering and evanescent objects which thus break from invisibility upon our gaze, flash along the sky singly or in shoals, and vanish after the apparition of a few seconds? Are they affairs of chance-medley? Or are they reducible to the empire of law? Of course the idea of accident in the case is peremptorily excluded by the fact of periodicity established with reference to the great meteor streams which sparkle in the dusky air of the summer and autumnal nights. Equally so does the same considera-

tion render the operation of physical laws certain in relation to these singular bodies, though we cannot at present solve the mystery of their origin, explain



the cause of their luminosity, or say precisely in relation to any one of them whence it cometh and whither it goeth. At the commencement of the century, the discovery of a few exceptionally minute orbs circling around the sun between Mars and Jupiter afforded sensible proof that inter-planetary space is not the void it was once supposed to be. Remarkably has evidence accumulated upon this point since the date mentioned. It embraces a large increase of the planetoid family by the detection of new members belonging to it, still in course of multiplication; an immense number of comets which traverse the system in all directions, undergoing extraordinary changes in form amounting to complete disruption; and millions upon millions of meteoric masses which are known to have a real cosmical connection with certain comets, as if their debris. It has been decisively established that the August stream traverses an orbit identical with that of a comet known as III. 1842, while the great November stream follows the course of Tempel's comet which appeared in 1806. It is highly probable, therefore, that some of the large comets upon which the ancients gazed with wonder, and which have appeared with vastly diminished splendor on their successive returns to perihelion, are now chiefly represented by hocks of meteors.

Thus the fact is certain, that independently of the great planets and satellites of the system, there are vast numbers of bodies circling around the sun, both singly and in groups, some also moving as minute moons around the earth; and that in the course of their revolutions these "starlets," or "meteor-planets," as they have been called, come within the sphere of the earth's attraction, and are precipitated upon its surface, "as weary and forlorn birds of passage, far out at sea, are entangled in the rigging of vessels, and fall helpless on deck."

CHAPTER X. A GLANCE AT THE STARS.

We have been chiefly occupied hitherto with those celestial bodies, which from their conspicuous appearance or changes of position, and some of them from their obvious connection with the convenience and existence of the human race, have in all ages been objects of special attention. Most of these bodies are situated within the limits of the zodiac, an imaginary zone or girdle extending around the heavens, of about sixteen degrees in breadth. It includes the sun and moon, and also all the planets, with the exception of the planetoids. But in the zodiac, and throughout the whole celestial concave, we see scattered everywhere a number of radiant points of varying brightness, which appear to have always the same position with regard to each other. This has originated the title of the fixed stars, by which they are popularly known. The term, in an absolute sense, is inaccurate; for recent observations have detected changes in the mutual relations of many of these bodies, and it is probable that all of them are subject to translation. Owing to their vast distances their motions appear exceedingly slow to us, requiring the finest instruments to be perceptible; and hence they have a character of permanence in contrast with the planets, and the term "fixed" becomes comparatively applicable. The apparent immobility of these objects renders them of immense use in geography, navigation, and planetary astronomy; and hence the observation of the sidereal host, and the formation of accurate catalogues of its members, are among the most important of the labors of science.

In the earliest times of which we have any account, mankind appear to have been acquainted with the use of the stars as celestial guides in their travels by land and voyages on the deep. We may conclude their observance in the former circumstances to have had the precedence. Without being aware of some safe and sure method of directing their course by night, acquired in journeys on shore, men would hardly venture upon a night voyage at sea. It must appear marvellous in the extreme to the uninformed, that now the skillful navigator, on a before unvisited ocean, can determine positively where he is, to within a few miles, by means of the stars; and ascertain his distance from, and true course to, any known meridian or harbor of the globe. From the deck of his ship he has merely to measure the moon's apparent distance from certain stars, to compare the result with their true places as given in the Nautical Almanac for every day in the year, and he finds his longitude. There are nine conspicuous stars which are chiefly used for this purpose, owing to their position being contiguous to the moon's path in the heavens;— α Arietis, Aldebaran, Pollux, Regulus, ϵ Virginis, Antares, Altair, Fomalhaut, and Markab.

On a clear night in winter, when the moon is absent, the heavens exhibit an aspect of great brilliancy. But to see the stars to advantage, in the utmost of

that glory which they reveal to the gaze of man, we must cruise in tropical seas, or wander with the Bedouins in their deserts. There, through a more transparent medium, the lesser lights of heaven shine with a lustre and vivacity of which we have no conception, who are only familiar with a denser atmosphere. Known to be at a distance from us, in comparison with which the interval between us and the farthest planet is but a hand-breadth, the stars far surpass that planet in their light, and hence it follows that they are not like him, dependent upon the central luminary of our system, but self-luminous bodies, independent suns. This is rendered unquestionable by the fact, that while every reflected light is susceptible of polarisation, the light of the stars, like that of the sun, is incapable of it. The tremulous emission of the stellar light, the scintillation or twinkling of the stars, is a remarkable feature, and was long a puzzle to philosophers. It is now generally supposed to arise from the molecules of the atmosphere constantly undergoing sudden compressions and dilations, which produce changes in its refractive power, and consequent changes in the direction of the rays of light, apparently every moment displacing the stars. The effect is not so sensible in the case of the planets because of their disks. These, though small, are of sufficient magnitude to bear without so much disturbance the minute agitations of the atmosphere, whereas the stars, being only brilliant points, without any perceptible diameter, are completely displaced. It has been observed, that in serene climates, and on the tops of high mountains, the twinkling of the stars is much less powerful than when viewed from other situations, which tends to confirm the preceding explanation as the true one.

On directing the eye to the celestial vault, the impression made upon the mind is that of an incalculable number of stars being visible—that of the army of heaven consisting of a host which our arithmetic will not suffice to reckon. It is well known that this is an optical illusion. Their twinkling and disorderly position in the sky confuse and deceive the sight. They are so scattered as not to be included at once in the field of vision. Hence arises the idea, that the visible number, which is really very limited, is, on the contrary, immense. But an ordinary eye will only discern at one time about three thousand in our firmament under the most favorable circumstances; and including both hemispheres, there will not be more than six thousand which a keen and experienced gaze will reach. The Greek and Arabian astronomers distinguished some of the brightest stars by particular names, which are recognized in our nomenclature of the heavens, as Sirius, Aldebaran, Rigel, Arcturus, Capella, Canopus, and Fomalhaut, though a different mode of proceeding, is now adopted, having become necessary by the large additions made to the ancient catalogues. To distinguish the stars in a constellation, the letters of the Greek alphabet are now employed; when these are exhausted, those of the Romans are used; and when these fail, numerals are resorted to. Referring to the whole host of heaven, the stars are divided into classes, according to their apparent brightness, which range from those of the first magnitude, or the brightest, down to the sixteenth; but all after the sixth are invisible to the naked eye, and are hence called telescopic objects.

They are further distinguished by being formed into artificial groups or constellations. This is a convenient arrangement in itself, analogous to the civil divisions of the globe, its empires, states and cities. But, unfortunately, celestial objects have not been grouped with judgment and care, having been the work, for the most part, of unknown authors in an age remote and rude. Hence we have constellations running into each other,—men, animals, birds, and dragons, jumbled together in the most disorderly manner.

In the following list the constellations of both hemispheres at present recognized are given, with the principal stars in each, and the names of the constructors; but those of Aratus and Ptolemy merely denote the constellations that are found in their lists, and all that the former enumerates must be added to those recorded by the latter.

SIDERIAL CONSTELLATIONS.				
NAME OF CONSTELLATIONS.	Author.	No. of Stars.	Principal Stars.	Magnitude.
SOUTHERN CONSTELLATIONS.				
Aries, the Ram.	Aratus	66	α Arietis.	3
Taurus, the Bull.	"	141	Aldebaran.	1
Gemini, the Twins.	"	88	Pollux, Castor.	2
Cancer, the Crab.	"	88	Arcturus.	1
Leo, the Lion.	"	100	Sirius, Denebola.	1
Virgo, the Virgin.	"	110	ϵ Virginis.	1
Libra, the Balance.	"	88	Zosma, Moll.	1
Scorpio, the Scorpion.	"	88	Antares.	1
Sagittarius, the Archer.	"	88	"	"
Capricornus, the Goat.	"	88	"	"
Aquarius, the Water-bearer.	"	110	Sichon.	3
Pisces, the Fishes.	"	110	"	"
NORTHERN CONSTELLATIONS.				
Ursa Minor, the Lesser Bear.	"	36	Pole-star.	2
Ursa Major, the Great Bear.	"	88	Dubhe, Alcor.	2
Perseus, and Head of Medusa.	"	88	Alcor, Alcor.	2
Auriga, the Waggoner.	"	88	Sirius.	1
Bowen, the Herdsman.	"	88	Arcturus.	1
Orion, the Dragon.	"	88	Rigel.	1
Canis Major, the Hunting Dog.	Hevelius	20	"	"
Cor Caroli, Heart of Charles II.	Aratus	10	"	"
Triangulum, the Triangle.	Aratus	10	"	"
Triangulum minus.	Aratus	10	"	"
Musca, the Fly.	Aratus	10	"	"
Ursa Minor, the Lesser Lion.	Aratus	44	"	"
Coma Berenices, Berenice's Hair.	Aratus	44	"	"
Canis Minor, the Little Dog.	Aratus	44	"	"
Antares, the Southern Crown.	Aratus	44	"	"
Scorpio, the Scorpion.	Aratus	44	"	"
Sagittarius, the Archer.	Aratus	44	"	"
Capricornus, the Goat.	Aratus	44	"	"
Aquarius, the Water-bearer.	Aratus	44	"	"
Pisces, the Fishes.	Aratus	44	"	"
Ursa Minor, the Lesser Lion.	Aratus	44	"	"
Coma Berenices, Berenice's Hair.	Aratus	44	"	"
Canis Minor, the Little Dog.	Aratus	44	"	"
Antares, the Southern Crown.	Aratus	44	"	"
Scorpio, the Scorpion.	Aratus	44	"	"
Sagittarius, the Archer.	Aratus	44	"	"
Capricornus, the Goat.	Aratus	44	"	"
Aquarius, the Water-bearer.	Aratus	44	"	"
Pisces, the Fishes.	Aratus	44	"	"
Ursa Minor, the Lesser Lion.	Aratus	44	"	"
Coma Berenices, Berenice's Hair.	Aratus	44	"	"
Canis Minor, the Little Dog.	Aratus	44	"	"
Antares, the Southern Crown.	Aratus	44	"	"
Scorpio, the Scorpion.	Aratus	44	"	"
Sagittarius, the Archer.	Aratus	44	"	"
Capricornus, the Goat.	Aratus	44	"	"
Aquarius, the Water-bearer.	Aratus	44	"	"
Pisces, the Fishes.	Aratus	44	"	"
Ursa Minor, the Lesser Lion.	Aratus	44	"	"
Coma Berenices, Berenice's Hair.	Aratus	44	"	"
Canis Minor, the Little Dog.	Aratus	44	"	"
Antares, the Southern Crown.	Aratus	44	"	"
Scorpio, the Scorpion.	Aratus	44	"	"
Sagittarius, the Archer.	Aratus	44	"	"
Capricornus, the Goat.	Aratus	44	"	"
Aquarius, the Water-bearer.	Aratus	44	"	"
Pisces, the Fishes.	Aratus	44	"	"
Ursa Minor, the Lesser Lion.	Aratus	44	"	"
Coma Berenices, Berenice's Hair.	Aratus	44	"	"
Canis Minor, the Little Dog.	Aratus	44	"	"
Antares, the Southern Crown.	Aratus	44	"	"
Scorpio, the Scorpion.	Aratus	44	"	"
Sagittarius, the Archer.	Aratus	44	"	"
Capricornus, the Goat.	Aratus	44	"	"
Aquarius, the Water-bearer.	Aratus	44	"	"
Pisces, the Fishes.	Aratus	44	"	"
Ursa Minor, the Lesser Lion.	Aratus	44	"	"
Coma Berenices, Berenice's Hair.	Aratus	44	"	"
Canis Minor, the Little Dog.	Aratus	44	"	"
Antares, the Southern Crown.	Aratus	44	"	"
Scorpio, the Scorpion.	Aratus	44	"	"
Sagittarius, the Archer.	Aratus	44	"	"
Capricornus, the Goat.	Aratus	44	"	"
Aquarius, the Water-bearer.	Aratus	44	"	"
Pisces, the Fishes.	Aratus	44	"	"
Ursa Minor, the Lesser Lion.	Aratus	44	"	"
Coma Berenices, Berenice's Hair.	Aratus	44	"	"
Canis Minor, the Little Dog.	Aratus	44	"	"
Antares, the Southern Crown.	Aratus	44	"	"
Scorpio, the Scorpion.	Aratus	44	"	"
Sagittarius, the Archer.	Aratus	44	"	"
Capricornus, the Goat.	Aratus	44	"	"
Aquarius, the Water-bearer.	Aratus	44	"	"
Pisces, the Fishes.	Aratus	44	"	"
Ursa Minor, the Lesser Lion.	Aratus	44	"	"
Coma Berenices, Berenice's Hair.	Aratus	44	"	"
Canis Minor, the Little Dog.	Aratus	44	"	"
Antares, the Southern Crown.	Aratus	44	"	"
Scorpio, the Scorpion.	Aratus	44	"	"
Sagittarius, the Archer.	Aratus	44	"	"
Capricornus, the Goat.	Aratus	44	"	"
Aquarius, the Water-bearer.	Aratus	44	"	"
Pisces, the Fishes.	Aratus	44	"	"
Ursa Minor, the Lesser Lion.	Aratus	44	"	"
Coma Berenices, Berenice's Hair.	Aratus	44	"	"
Canis Minor, the Little Dog.	Aratus	44	"	"
Antares, the Southern Crown.	Aratus	44	"	"
Scorpio, the Scorpion.	Aratus	44	"	"
Sagittarius, the Archer.	Aratus	44	"	"
Capricornus, the Goat.	Aratus	44	"	"
Aquarius, the Water-bearer.	Aratus	44	"	"
Pisces, the Fishes.	Aratus	44	"	"
Ursa Minor, the Lesser Lion.	Aratus	44	"	"
Coma Berenices, Berenice's Hair.	Aratus	44	"	"
Canis Minor, the Little Dog.	Aratus	44	"	"
Antares, the Southern Crown.	Aratus	44	"	"
Scorpio, the Scorpion.	Aratus	44	"	"
Sagittarius, the Archer.	Aratus	44	"	"
Capricornus, the Goat.	Aratus	44	"	"
Aquarius, the Water-bearer.	Aratus	44	"	"
Pisces, the Fishes.	Aratus	44	"	"
Ursa Minor, the Lesser Lion.	Aratus	44	"	"
Coma Berenices, Berenice's Hair.	Aratus	44	"	"
Canis Minor, the Little Dog.	Aratus	44	"	"
Antares, the Southern Crown.	Aratus	44	"	"
Scorpio, the Scorpion.	Aratus	44	"	"
Sagittarius, the Archer.	Aratus	44	"	"
Capricornus, the Goat.	Aratus	44	"	"
Aquarius, the Water-bearer.	Aratus	44	"	"
Pisces, the Fishes.	Aratus	44	"	"
Ursa Minor, the Lesser Lion.	Aratus	44	"	"
Coma Berenices, Berenice's Hair.	Aratus	44	"	"
Canis Minor, the Little Dog.	Aratus	44	"	"
Antares, the Southern Crown.	Aratus	44	"	"
Scorpio, the Scorpion.	Aratus	44	"	"
Sagittarius, the Archer.	Aratus	44	"	"
Capricornus, the Goat.	Aratus	44	"	"
Aquarius, the Water-bearer.	Aratus	44	"	"
Pisces, the Fishes.	Aratus	44	"	"
Ursa Minor, the Lesser Lion.	Aratus	44	"	"
Coma Berenices, Berenice's Hair.	Aratus	44	"	"
Canis Minor, the Little Dog.	Aratus	44	"	"
Antares, the Southern Crown.	Aratus	44	"	"
Scorpio, the Scorpion.	Aratus	44	"	"
Sagittarius, the Archer.	Aratus	44	"	"
Capricornus, the Goat.	Aratus	44	"	"
Aquarius, the Water-bearer.	Aratus	44	"	"
Pisces, the Fishes.	Aratus	44	"	"
Ursa Minor, the Lesser Lion.	Aratus	44	"	"
Coma Berenices, Berenice's Hair.	Aratus	44	"	"
Canis Minor, the Little Dog.	Aratus	44	"	"
Antares, the Southern Crown.	Aratus	44	"	"
Scorpio, the Scorpion.	Aratus	44	"	"
Sagittarius, the Archer.	Aratus	44	"	"
Capricornus, the Goat.	Aratus	44	"	"
Aquarius, the Water-bearer.	Aratus	44	"	"
Pisces, the Fishes.	Aratus	44	"	"
Ursa Minor, the Lesser Lion.	Aratus	44	"	"
Coma Berenices, Berenice's Hair.	Aratus	44	"	"
Canis Minor, the Little Dog.	Aratus	44	"	"
Antares, the Southern Crown.	Aratus	44	"	"
Scorpio, the Scorpion.	Aratus	44	"	"
Sagittarius, the Archer.	Aratus	44	"	"
Capricornus, the Goat.	Aratus	44	"	"
Aquarius, the Water-bearer.	Aratus	44	"	"
Pisces, the Fishes.	Aratus	44	"	"
Ursa Minor, the Lesser Lion.	Aratus	44	"	"
Coma Berenices, Berenice's Hair.	Aratus	44	"	"
Canis Minor, the Little Dog.	Aratus	44	"	"
Antares, the Southern Crown.	Aratus	44	"	"
Scorpio, the Scorpion.	Aratus	44	"	"
Sagittarius, the Archer.	Aratus	44	"	"
Capricornus, the Goat.	Aratus	44	"	"
Aquarius, the Water-bearer.	Aratus	44	"	"
Pisces, the Fishes.	Aratus	44	"	"
Ursa Minor, the Lesser Lion.	Aratus	44	"	"
Coma Berenices, Berenice's Hair.	Aratus	44	"	"
Canis Minor, the Little Dog.	Aratus	44	"	"
Antares, the Southern Crown.	Aratus	44	"	"
Scorpio, the Scorpion.	Aratus	44	"	"
Sagittarius, the Archer.	Aratus	44	"	"
Capricornus, the Goat.	Aratus	44	"	"
Aquarius, the Water-bearer.	Aratus	44	"	"
Pisces, the Fishes.	Aratus	44	"	"
Ursa Minor, the Lesser Lion.	Aratus	44	"	"
Coma Berenices, Berenice's Hair.	Aratus	44	"	"
Canis Minor, the Little Dog.	Aratus	44	"	"
Antares, the Southern Crown.	Aratus	44	"	"
Scorpio, the Scorpion.	Aratus	44	"	"
Sagittarius, the Archer.	Aratus	44	"	"
Capricornus, the Goat.	Aratus	44	"	"
Aquarius, the Water-bearer.	Aratus	44	"	"
Pisces, the Fishes.	Aratus	44	"	"
Ursa Minor, the Lesser Lion.	Aratus	44	"	"
Coma Berenices, Berenice's Hair.	Aratus	44	"	"
Canis Minor, the Little Dog.	Aratus	44	"	"
Antares, the Southern Crown.	Aratus	44	"	"
Scorpio, the Scorpion.	Aratus	44	"	"
Sagittarius, the Archer.	Aratus	44	"	"
Capricornus, the Goat.	Aratus	44	"	"
Aquarius, the Water-bearer.	Aratus	44	"	"
Pisces, the Fishes.	Aratus	44	"	"
Ursa Minor, the Lesser Lion.	Aratus	44	"	"
Coma Berenices, Berenice's Hair.	Aratus	44	"	"
Canis Minor, the Little Dog.	Aratus	44	"	"
Antares, the Southern Crown.	Aratus	44	"	"
Scorpio, the Scorpion.	Aratus	44	"	"
Sagittarius, the Archer.	Aratus	44	"	"
Capricornus, the Goat.	Aratus	44	"	"
Aquarius, the Water-bearer.	Aratus	44	"	"
Pisces, the Fishes.	Aratus	44	"	"
Ursa Minor, the Lesser Lion.	Aratus	44	"	"
Coma Berenices, Berenice's Hair.	Aratus	44	"	"
Canis Minor, the Little Dog.	Aratus	44	"	"
Antares, the Southern Crown.	Aratus	44	"	"
Scorpio, the Scorpion.	Aratus	44	"	"
Sagittarius, the Archer.	Aratus	44	"	"
Capricornus, the Goat.	Aratus	44	"	"
Aquarius, the Water-bearer.	Aratus	44	"	"
Pisces, the Fishes.	Aratus	44	"	"
Ursa Minor, the Lesser Lion.	Aratus	44	"	"
Coma Berenices, Berenice's Hair.	Aratus	44	"	"
Canis Minor, the Little Dog.	Aratus	44	"	"
Antares, the Southern Crown.	Aratus	44	"	"
Scorpio, the Scorpion.	Aratus	44	"	"
Sagittarius, the Archer.	Aratus	44	"	"
Capricornus, the Goat.	Aratus	44	"	"
Aquarius, the Water-bearer.	Aratus	44	"	"
Pisces, the Fishes.	Aratus	44	"	"
Ursa Minor, the Lesser Lion.	Aratus	44	"	"
Coma Berenices, Berenice's Hair.	Aratus	44	"	"
Canis Minor, the Little Dog.	Aratus	44	"	"
Antares, the Southern Crown.	Aratus	44	"	"
Scorpio, the Scorpion.	Aratus	44	"	"
Sagittarius, the Archer.	Aratus	44	"	"
Capricornus, the Goat.	Aratus	44	"	"

ASTRONOMY.—SCENERY OF THE HEAVENS.

SOUTHERN CONSTELLATIONS.

The * indicates those constellations which never rise in North latitude 33°.

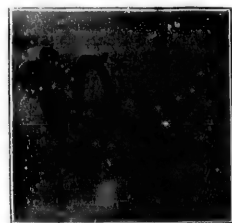
NAME OF CONSTELLATIONS.	Author.	No. of Stars.	Principal Stars.	Magnitudes.
The Aps.*	Bayer	13		
Apparatus sculptoris,* the sculptor's Apparatus	Locatelle	10		
Pygmaeus Pictus, the River Po,	Aratus	94	Achernar,	3
Hydra,* the Water Snake,	Bayer	10	Meakar,	3
Cetus, the Whale,	Aratus	97		
Formica Chemica, the Chemical Furnace,	Locatelle	14		
Horologium,* the Clock,	"	13		
Helicium Helicoides,* the Helicoid Shell,	Bayer	7		
Sphinx Isardi,* the Sphinx Fish,	Locatelle	16		
Cleopatra,* the Engraver's Tools,*	Aratus	19		
Lepus, the Hare,	Aratus	10		
Columba Nocchi, Noah's Dove,	Aratus	94	Antelope, Hare,	1-1
Orion,*	Locatelle	31	Cassiopeia,	1
Argo Navis, the Ship Argo,	Aratus	21	Antelope,	1
Canis Major, the Great Dog,	Locatelle	10	Procyon,	1
Equuleus Fictus, the Fictitious Horse,	Bayer	10		
Monoceros, the Unicorn,	Aratus	8		
Canis Minor, the Little Dog,	Aratus	41		
Chamaeleon,*	Locatelle	13		
Pyxis Ventris, the Mariner's Compass,	Aratus	81	Alker,	3
Piscis Volans,* the Flying Fish,	Aratus	11	Algerab,	1
Hydra, the Serpent,	Aratus	41	Crucis,	1
Scorpio, the Scorpion,	Aratus	13		
Bohr Carlinum,* the Oak of Charles II.,	Locatelle	2		
Antlia Pneumatica, the Air Pump,	Aratus	8		
Crater, the Cup,	Bayer	11		
Corvus, the Crow,	Bayer	11		
Crux,* the Cross,	Aratus	24		
Aps Mada, the Bee, or Fly,	Aratus	8		
Antlia,* the Bird of Paradise,	Aratus	9		
Circinus,* the Compass,	Locatelle	13		
Centaurus, the Centaur,	Aratus	36		
Lepus, the Wolf,	Locatelle	13		
Triangulum Australe,* South Triangle,	Bayer	8		
Arcturus,* the Star,	Aratus	9		
Telescopium,* the Telescope,	Locatelle	13		
Corvus Australis, the Southern Crow,	Aratus	13		
Pavo,* the Peacock,	Bayer	13		
Indus,* the Indian,	Locatelle	13		
Microscopium, the Microscope,	Aratus	43		
Ophiuchus,* Hadley's Octant,	Bayer	14		
Crux,* the Cross,	Aratus	36		
Fornax, the American Goose,	Aratus	36		
Piscis Australis, the Southern Fish,	Locatelle	36		
Monoceros,* the Unicorn,				

SUMMARY.

Constellation.	Stars.
Zodiacal, - - - - -	13
North, - - - - -	1016
South, - - - - -	108
- - - - -	396
- - - - -	3387

The number of stars assigned to each constellation chiefly includes those whose declination and right ascension were accurately ascertained by Flamsteed, and appear in the third volume of his "Historia Cœlestis Britannica." Declination is the distance of any heavenly body either north or south of the equinoctial, measured on a meridian. Right ascension is its distance east from the first point of Aries, measured on the equinoctial. The former corresponds to terrestrial latitude, and the latter to terrestrial longitude; but while declination, like latitude, may extend to 90°, and no more, right ascension is reckoned only in one direction, and may therefore extend around the sphere, or to 360°, whereas terrestrial longitude, being reckoned east and west, can only extend to 180°.

Owing to the precession of the equinoxes, a change has occurred in the relation between the signs of the zodiac and their respective asterisms, which is somewhat puzzling to the general reader, who is apt to confound the sign with the constellation called after it. Two thousand years ago, in the days of Hipparchus, the zodiacal signs and asterisms corresponded, so that when the sun entered the first point of the sign Aries, he entered also the constellation of that name. Then the equinoctial colure, an imaginary great circle passing through



the poles of the heavens and the sun's place at the vernal equinox, intersected the stellar ram, as some ancient representations testify. But as the equinoctial points retrograde about 50' annually, they have receded nearly 31° since the time of Hipparchus, or more than a whole sign. The effect has been to separate the asterisms from their denominational signs, so that the constellation Pisces is now in the sign Aries, the constellation Aries in the sign Taurus, and the tropics of Cancer and Capricorn, according to the sun's place among the stars, have become the tropics of Gemini and Sagittarius. Four thousand years back, anterior to the time of the Hebrew patriarchs, the sun was in the asterism Taurus at the vernal equinox, and the Bull opened the astronomical year; and two thousand years hence, the asterism Aquarius will occupy the present position of Pisces, and lead on the celestial host for a similar period. All confusion will be avoided, by discriminating between the constellations and the signs of the zodiac, the signs bearing the same name, understanding by the former the asterisms, and by the latter certain sections of the ecliptic. In about twenty-three thousand years, the zodiacal constellations and signs will again nominally agree.

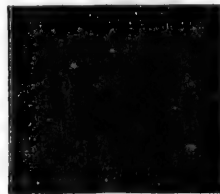
The constellation ARIES is situated in the heavens next east of Pisces, and midway between Triangulum and Musca on the north, and the head of Cetus on the south. It is readily distinguished by means



of two bright stars in the head of the Ram, about 4° apart, the brightest being the most northeasterly of the two. This is the nautical star α Arietis, called Hamal by the Arabs, of the second magnitude; the other, Sheratan, is of the third. Here is one instance out of many, where stars of more than ordinary brightness are seen together in pairs, the brightest being generally on the east.

TAURUS, one of the finest of the zodiacal asterisms, has Perseus and Auriga on the north, Gemini on the east, Orion and Eridanus on the south, and Aries on the west. It includes the two remarkable clusters, the Pleiades and Hyades, the former on the shoulder, and the latter in the face of the Bull, about 11° apart. The Hyades consist of five stars, so placed as to form the letter V, the brilliant star, Aldebaran, of the first magnitude, being on the top of the letter to the left. This group is just rising in the east when Aries is about 27° high.

The Pleiades have gone through some evil and good report. Figuring conspicuously in our winter sky, Statius calls them a snowy constellation; Valerius Flaccus speaks of their danger to ships; while Horace pictures the south-



presence of the stellar sisterhood. But as the Pleiades were more in juxtaposition with the sun at the vernal equinox in bygone days than at present, the Romans sometimes called them Vergillia, or the 'Virgins of the Spring.'

GEMINI is situated with the Lynx on the north, Taurus on the west, Cancer on the east, Monoceros and Canis Minor on the south. It is easily known by the two principal stars, Pollux and Castor, the former of the first, and the latter of the second magnitude, about 4½° apart. The constellation was anciently represented by two kids, which the Greeks changed into the twin-brothers after whom the two stars are named, and which the Arabians altered into peacocks. A small star of the fifth magnitude, Propus, is memorable on account of Herschel finding Uranus in its neighborhood, and as having served for many years to guide astronomers to that planet.



CANCER is inferior to most of the other constellations along the solar highway, having no conspicuous stars. Two of the fourth magnitude the Romans called Aselli; and a nebulous cluster of very minute stars, sufficiently luminous however to be seen by the naked eye, exists at the distance of about 2° from the Asses. This cluster goes by the name of Præsepe, or the Manger, out of accommodation to them.

LEO, situated next east of Cancer, and directly south of Leo Minor and Ursa Major, makes a fine brilliant appearance in the sky, boasting



"Two splendid stars of highest dignity."

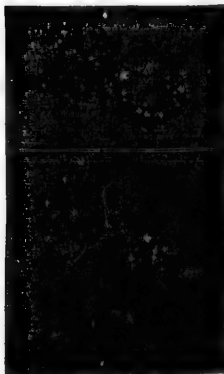
with several that are conspicuous objects. Regulus, a star of the first magnitude, and Denebola, one of the second, are about 25° apart, the former in the breast of the Lion, hence often called Cor Leonis, the other is situated in the tail.

VIRGO, represented as a woman holding an ear of corn, a mythological personage has Leo on the east, Coma Berenices on the north, and Corvus on the south. The asterism is rich in stars, the chief of which is Spica Virginis, a first-class star in the wheat-ear, known by its solitary splendor, there being no visible star near it but one of the fourth magnitude. For this reason, it was called by the Arabs *As-Simak-al-azal*, the unarmed or defenceless Simak. The place of this star, as determined by Hipparchus, compared with a similar determination a century and a half before, led to the discovery of the precession of the equinoxes.

AQUARIUS is more easily recognizable by the eye, having four stars distinctly forming the letter Y about the urn which the water-bearer is pictured emptying of its contents. The Arabs, not being allowed by their prophet to depict the human figure, represented this asterism by a mule carrying water-barrels, and for the same reason they changed the twins Gemini into peacocks.

LIBRA, the balance, the emblem of the office of Virgo as the goddess of justice, has four subordinate but still conspicuous stars. They form a quadrilateral figure, two on the northeast, about 7° apart, and two on



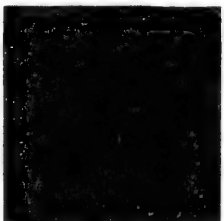


the southwest, about 6° apart, distinguishing the Scia.

SCORPIO exhibits a beautiful collection of stars. One of the first magnitude, the fiery Antares, is a paramount object in this region of the heavens. Four smaller stars form an arc over him not unlike a boy's tail, and ten more conspicuous extend from him in a crooked line, answering to a kite's tail.

SAGITTARIUS has none but subordinate stars, but many of these are very distinct, and may be ranged into a variety of geometrical figures. Eight of the principal form two quadrangles, nearly alike, four in and four out of the Milky Way, by which the constellation is readily distinguished.

CAPRICORNUS, with Cancer, is one of the least striking of the zodiacal asterisms, but one of the most celebrated among the ancients, as the sign under which Augustus and Vespasian were born, hence accounted the harbinger of good fortune, and as marking the southern tropic, or winter solstice, and therefore called the "Southern Gate of the Sun." Now, in consequence of the precession of the equinoctial and solstitial points, the sun is in the sign Capricorn at midwinter, but does not reach the constellation until the middle of January.



PISCES is a loose assemblage of small stars, difficult to be traced, occupying a large triangular space in the heavens. This is now the first constellation in order in the zodiac, that which presides over the vernal equinox, a position to be occupied for centuries to come, but ultimately resigned to Aquarius, after a tenure of office extending to somewhat more than two thousand years. It will be seen, that the most imposing of the zodiacal asterisms are those which the sun now traverses in our summer months. They are then lost to us by reason of his effulgence, but are splendid objects during the long nights of winter. The time, however, will arrive when the sun's high road will lie through these asterisms in winter, and Taurus, Gemini, and Leo, will be lacking in our heavens during the winter nights, appearing in the nights of summer, but with less splendor, owing to the strength and duration of the twilight.

Directing attention to the constellated groups of the northern hemisphere, the most conspicuous and splendid is Ursa Major, supposed to have derived its name from its situation near the north pole, and from its constant visibility in our unclouded night sky, because the polar regions are the haunts of the bear, an animal which neither makes extensive journeys nor rapid marches. It is singular that the Iroquois, a savage tribe of America, should have designated this region of the heavens by the name which the earliest Arabs of Asia applied to it, the Great Bear—two nations, far remote from each other, employing a title which is purely arbitrary, as the group of stars exhibits no resemblance to the animal.

As Ursa Major is always above the horizon of Europe, it has been an object of universal observation to its inhabitants in all ages of the world, and is familiarly known to those who take no interest in astronomy by three stars which form a triangle in the tail, and four a quadrangle in the body of the Bear. Commencing with the former, the first star at the tip of the tail is Benetnasch of the second magnitude; the second Mizar, and the third Alioth; and passing to the latter the first star at the root of the tail is Megrez; the second below it, Phad; the third in a horizontal direction, Merak; and the fourth above the latter, Dubhe, of the first magnitude. By common consent, the two latter stars, Merak and Dubhe, are called the Pointers, because an imaginary line drawn from the lower to the upper, and carried on in the same direction, passes almost over Polaris in Ursa Minor, a star close to the north polar point of the heavens, from which its name is derived. It may be useful here to state, for the purpose of measuring angular distances in the heavens with the eye, that the space between the Pointers may be approximately considered 5°, and between the Pointers and the pole-star, 25°. The direction merely of the polar star is exhibited in the diagram, and not the distance. Ursa Minor has no conspicuous stars, nor anything remarkable in its appearance; but from the important service rendered by its position to navigation and surveying, it has engrossed more of the serious attention of mankind than any other constellation in the skies. Polaris is a star between the second and third magnitude. It appears stationary during the apparent daily revolution of the sphere, the rest of the stars in the asterism making a complete swing around

it every twenty-four hours, as in the diagram. The pole-star is not, however, the true polar point, but at present about 1° 32' from it, a distance which will be lessened down to 26' 30" about the year 2100. At the time when the Chaldean shepherds watched the heavens, a star in Draco, now 24° 52' from the polar point, was within 16' of it, and was consequently the pole-star of that era. The proximity of Polaris to that point in the heavens which is directly opposite the north pole of the earth, enables the mariners and travelers in the



northern hemisphere with facility to find their latitude, for the distance of a place from the equator is always equal to the altitude of the pole. The navigator therefore applies his quadrant to the polar star, ascertains its elevation, and after making allowance for its polar aberration, he arrives at his latitude. The same advantage is not enjoyed on the other side of the equator, for the southern heavens have no guide so convenient to the south polar point. In close attendance upon the Bears, the ancients arranged the asterism Arctophylax, the Bear-keeper, otherwise called Bootes, the Herdsman, now represented holding

in his left hand the leash of the two grey-hounds of Hevelius, apparently pursuing Ursa Major around the pole of the heavens. The fine star Arcturus, of the first magnitude, is in this constellation, once supposed to be the nearest to the earth of the stellar host, but without authority.

Of the stars of the southern hemisphere, only a portion of course are visible to us, but these are by far the most important, and constitute the finest stellar objects upon which we gaze. There is the beautifully splendid Orion, visible to all the habitable world, because the equinoctial passes through the middle of the constellation, and when on the meridian with us, we have at the same time



the most remarkable asterisms in the firmament above the horizon. The outline of Orion is very distinctly marked by four brilliant stars which form a long square or parallelogram. The most northerly is Betelgeuse of the first magnitude; 7½° westward is Bellatrix of the second; 15° to the south is Rigel, a splendid star of the first magnitude; and 8½° to the east is Saiph of the third. The two former form the upper ends of the parallelogram, and the two latter the lower. In the centre are three stars of the second magnitude, in a straight line of about 3' in length, running from northwest to southeast. These form the well-known belt of Orion. The uppermost of the triad being less than ½° south of the equinoctial, is almost exactly vertical to the equator. South of the Belt, a row of smaller stars running down obliquely toward Saiph forms the Sword. This fine asterism, in connection with the groups in its neighborhood, constitutes the richest part of the visible heavens. Orion has the bright clusters of Taurus giving splendor to his vicinity on the northwest; Canis Minor with Procyon, a star of the first magnitude, on the east; and Canis Major, a little on the southeast, universally known by the brilliancy of Sirius, the most refulgent and once thought the nearest object in the sidereal heavens. Southeast of Canis Major is the asterism of the ship Argo, in which Chionopus shines, the second of the stars in point of lustre, but invisible to all parts of the earth of higher latitude than the northern coast of the Mediterranean. An observer in the northern hemisphere can only see the stars as many degrees south of the equinoctial in the southern hemisphere as his own latitude lacks of 90°. All whose southern declination is greater never reach his horizon.

Among the stars of the south, the constellation of the Cross is described as pre-eminent—the most interesting object in the sky of that hemisphere on account of the associations connected with it by a Christianised imagination. It consists of four bright stars, to which the fancy readily gives a cruciform shape, the upper and lower being the pointers to the south pole. The two great stars which mark the summit and the foot of the Cross have nearly the same right ascension; it follows that the constellation is almost perpendicular at the moment when it passes the meridian. This circumstance is known to every nation that lives beyond the tropics or in the southern hemisphere. It is known at what hour of the night, in different seasons, the Southern Cross is erect, or inclined. It is a timepiece, that advances very regularly nearly four minutes a day; and no other group of stars exhibits to the naked eye an



observation of time so easily made. A powerful impression is made upon the mind by the changed aspect of the celestial vault upon a first voyage to the southern hemisphere. The thought of being far from home occurs with a force never known before. By degrees, many of the old stars, those which have been watched in the northern sky, in the days of childhood and youth, with such interest and delight, decline towards

the horizon, sink below it, and are looked for in vain. Others customarily seen in the south approach the zenith, and pass to the north, while strangers rise above the southern horizon, ascending higher and higher, till a new heaven appears aloft, without any intimation that the old earth has passed away. Generally speaking, the southern celestial hemisphere is extremely dissimilar to the northern, not only in the grouping of the stars, but in its whole character. There are many large tracts or spaces of deep and solemn blackness—starless voids to the naked eye—which do not occur, or but rarely, in our own firmament. But these unlighted spaces give great effect by their darkness to the constellations; and render them in a high degree rich and magnificent. Yet notwithstanding these voids, as they appear to the naked eye, the southern firmament, when telescopically examined, is thought to be rather richer in stars than the northern.

To know the heavens at night so as to recognize the principal constellations and stars visible in our hemisphere—the first step of the tyro—seems at first a difficult undertaking. But a little practice, with the aid of good celestial charts, will soon make him feel at home in a cruise along the firmament. After becoming acquainted with the more remarkable groups, and their chief constituents, these will serve as an index to those that are less conspicuous. The maps accompanying this work, with the directions connected with them, will supply every requisite help for the purpose.

The best time for a survey of the heavens is during the long nights of winter in the absence of the moon; but in seeking to find his way among the stars by the aid of a celestial chart or globe, the student must bear in mind, that while their relative positions and distances are given, the constellations are continually varying their direction by reason of the apparent revolution of the sphere, after the manner of *Ursa Minor* swinging around *Polaris*, as represented in a previous diagram. By alignment, or drawing imaginary lines from star to star, forming a variety of geometrical figures, a general knowledge of them may be speedily acquired. Having become acquainted with the seven stars which compose the triangle and square of *Ursa Major*, his circumpolar neighbors are readily found by this method. Thus, while a straight line through the side of the square formed by the Pointers leads to *Polaris*, another through the top of the square inverse to the triangle leads to *Capella*, and from the first star of the triangle nearest the square a line carried through *Polaris* conducts to the bright cluster of *Cassiopeia*. From *Capella* a direct line through *Polaris* passes to the two stars *Alwaid* and *Elamin* in the head of *Draco*. Through the side of the square opposite the Pointers a line continued southward conducts to *Regulus*, east of which is *Denebola*, the two principal stars in *Leo*. *Denebola* forms an extensive square, with *Cor Caroli* occupying the northern point, *Arcturus* the eastern, and *Spica Virginis* the southern, in the interior of which is a cluster of small stars, the *Coma Berenices* of *Tycho Brahe*. The line joining *Arcturus* and *Spica Virginis* is also the base of a conspicuous triangle, of which *Antares* in *Scorpio* is the vertex to the east; and a large right-angled triangle is very nearly formed by *Arcturus*, *Polaris*, and *Vega*. Another remarkable figure, called the great square of *Pegasus*, is composed by the four leading stars in that constellation. Every one is familiar with the belt of *Orion*. A straight line drawn through it northward leads to *Aldebaran*, and southerly to *Sirius*. The star northeast of the belt, *Betelgeuse*, forms a triangle, with *Pollux* at the northern, and *Procyon* at the eastern point. By the practice of alignment, guided by a good map, the leading objects of the firmament will soon be recognized, nor is any costly observatory necessary in order to cultivate a more intimate acquaintance.

CHAPTER XI.

NUMBER, DISTANCE, AND MAGNITUDE OF STARS.

THE prevailing ideas of men concerning the multitude of the stars, though founded upon wrong premises, are yet in harmony with the literal fact, for the conclusion drawn from the hasty observation of the eye, which a persevering survey would at once disprove, is itself established by telescopic examination. So enormous is the number of the stars, yet so completely incalculable are they, as to admit of their being joined with the sand upon the sea-shore, as a figure of speech denoting a numeration which we cannot define. The common phrase of the Sacred Volume, the hosts of heaven, alludes to their multitude; and the fact is advanced as an illustration of the infinite grasp of the Creator's mind, that he is acquainted minutely with these multitudinous worlds, which immeasurably exceed our utmost estimates. "He calleth them all by names by the greatness of his might, for that he is strong in power; not one faileth." The earliest catalogue of the stars, that of *Ptolemy*, enumerates only 1022; that of *Ulugh-Beg*, the grandson of *Tamerlane*, made at *Samarcand*, contains 1017; but a comparison of the ancient with modern catalogues exhibits a striking difference in the assigned richness of the asterisms. Upwards of two thousand stars have been counted within the trapezium or unequal square of *Orion*, and the telescope multiplies them in the heavens without end, revealing points of light profusely distributed throughout all space, every point a sun attended probably by a train of planets, a reasonable inference from the constitution of the solar universe. *Lalande* in the last century registered the positions of fifty thousand, the various astronomers of Europe upwards of a hundred thousand, and *Struve* alone has since observed no less than a hundred and twenty thousand stars. But this is only a feeble approximation to the whole amount within telescopic range. Using an instrument of no great size—little more than two inches wide—there have been at present not less than 310,000 stars duly catalogued in the northern half of the heavens alone. It is estimated that the total number visible in the entire celestial vault would mount up to 77,000,000.

There are several parts of the firmament in which stars appear to the naked eye closely packed together, and others which present a general indivisible

luminosity to the unassisted vision. The chief of these are the *Pleiades*, *Hyades*, the *Milky Way*, and *Presepe*. The latter is a region faintly gleaming in the sombre districts of *Cancer*, which may be easily found by running a line through *Castor* and *Pollux*, and continuing it to the southeast about three times the distance between those stars. The *Hyades* appear to consist of five stars, but between thirty and forty are readily discernible under a moderate instrumental power. The *Pleiades* also yield a similar result, their optical number, six or seven, being largely multiplied by the application of a telescope. The *Milky Way* is found to be composed of stars which assume the appearance of a tortuous consecutive girdle of light, owing to their grouping and distance. Some idea may be formed of their profuseness from the fact that *Herschel* was led to the conclusion, when examining this wonderful region, that in some parts of it no less than fifty thousand were included within a zone two degrees in breadth, which passed under his review in a single hour's observation. Yet this is but a specimen of countless combinations which are discoverable in the concavity of the heavens, so remote from us as to escape the observation of the eye, yet recognized by its aided vision, forming clusters of various shapes, as rich in stars as the zone which we can analyze proves to be.

By some of the pagan philosophers the *Via Lactea* was regarded as an old disused path of the sun, of which he had got tired, or from which he had been driven, and had left some faint impression of his glorious presence upon it. Its stellar composition was, however, suspected long before it was proved, but its multitudinous host of stars remained a secret till *Herschel* turned his mighty instrument at Slough upon the silvery belt. In a single spot he counted



between five and six hundred without moving his telescope; and in a space of the zone not more extensive than 10° long by 3½° wide, he computed that there were no fewer than 258,000. Though the whole number of stars which the naked eye discerns on an ordinary night is small, yet, gazing upon the celestial vault at a high elevation in the atmosphere, largely improves the appearance of old, familiar stellar faces, and many are caught sight of which were before wholly invisible. Visiting the peaks of lofty mountains, the unaided eye of the adventurer who is there at night forms fresh acquaintances among the stars, and its friends of long standing glitter with a brilliance

which the denser regions of the atmosphere render obscure to the dwellers below.

To measure the distance of the stars, is a task which has baffled the ablest men. Until our own day, the conclusion arrived at had only been negative. It could merely be demonstrated, that the nearest of these bodies must at the least be removed from us a certain space, the extent of which requires the billions of our arithmetic to express. It is clearly ascertainable, that the enormous interval intervening between us and that remote wanderer in our system, *Neptune*, is but a narrow chasm compared with the interval between him and the most contiguous of the stellar orbs. On observing the same star, lying in the plane of the earth's orbit, from the two extremities of the orbit, at the end of six months, no perceptible alteration in the apparent size of the star can be discerned, notwithstanding this vast change of situation. The inference, therefore, is, that the diameter of the earth's orbit, the immense line of 188 millions of miles, bears no sensible proportion to the real distance of the stars. All the planets, even the remotest, appear in very different places when viewed at the vernal and autumnal equinoxes, or at any two extreme points of our globe's path; and if the angle subtended be given, the distance may be calculated. But no parallax of a star amounting even to a single second has been detected and *Bradley* makes the observation, which *Sir John Herschel* confirms, that if such an amount of parallax existed, it could not possibly have escaped notice. Supposing, however, a parallax of one second perceptible, that, by the rules of trigonometry, would give a distance from us of more than 19 billions of miles; but as there is no such quantity detectable, there is no star lying within that range—they all lie beyond it!

Parallax is the apparent change of place which an object undergoes through an observer shifting his own position. The traveler in journeying marks a great change in the same scenery, in the disposition of its various features, by the alteration of his own point of view. He observes the trees, fields, and hedgerows, which appeared in a direct line between him and some distant hill, at one station, making an angle with the eminence as seen from another station. Suppose we stand at *a*, and have two trees before us in the direct line



a b c, both will be projected to the same point *d*, but if we shift our position to *c*, then the nearest tree will be seen in the direction *f*, and the furthest in the direction *g*. By measuring the base line *a c*, and the angles *a b c*, and *a c d*, or the parallax, the mathematician readily arrives at the distance of the trees from the points of observation. Now with reference to estimating the distances of the stars, we have the diameter of

the earth's orbit as a capital base line to work upon, a real change of place occurring annually on our part in relation to them amounting to 183 millions of miles. Yet, notwithstanding this vast alteration of position, no angle of the value of a second has been found with certainty in the case of any star.

The diagram now subjoined, exhibits the earth at two extreme points of its orbit. Let the reader keep in mind the 183 millions of miles between these points, and then he may form some idea of the awful gulf between us and the stars, from the fact that the triangle formed by lines drawn from the extremes



of the orbit to a star at the vertex, has defied the most perfect instruments of human invention to measure, so inappreciable is it. Supposing the whole of that orbit filled with a globe resplendent as the sun, it would have a circumference of 900 millions of miles, and yet have only the appearance of a twinkling atom as seen from the nearest of the stars.

Previous to the determinations of Newton, the discovery of an annual parallax of the stars was a point of great interest in order to confirm the Copernican doctrine of the earth's motion in space. It was remarked by opponents, that if we are really sweeping at a prodigious rate in an enormous ellipse around the sun, then ought the stars to appear continually displaced, just as do the trees of the forest to the traveler flying swiftly past them, instead of which, seen from any point, and at any time, their position is ever the same—fixed, immutable, eternal. More than three centuries have rolled away since the controversy commenced. Though long since terminated by the truth of the grand theory of Copernicus being triumphantly established, yet astronomers have prosecuted with zeal the search after an annual parallax of the stars, in order to illustrate the scale upon which the universe is built; but no success attended the effort until our time.

The problem of stellar remoteness has been solved in the present age, in the first instance by the late Professor Bessel, of Königsberg, and has been justly styled a magnificent conquest. The world is indebted for it to one of the refracting telescopes of the celebrated Fraunhofer, of Munich, an instrument of extraordinary power, specially adapted to the research for the parallax of the fixed stars. With machinery even more delicate, and of a somewhat different kind, Bessel renewed the search after the unattained parallax of the stars. His instrument, called the *heliometer*, was mounted in the year 1829, but various causes delayed his principal operations up to the month of October, 1837.

The astronomer selected the star 61 Cygni as the one on which to perform his operations. In watching this star, Bessel commonly took observations sixteen times every night whenever opportunity offered. Without detailing the course he pursued, which would be uninteresting and unintelligible to most readers, it will be sufficient to state, that after a most careful investigation, a variation in the apparent place of the star began to show itself, increasing precisely as parallax variation ought to increase, and diminishing as it ought to diminish. The period of these changes was precisely a year; and in all particulars they corresponded exactly to the changes which ought to be produced by parallax. Still, on account of their minute character, the observer hesitated to place dependence upon them. But during another year of observation, the same results came out, and the previous values were confirmed. This was the case also during a third year; and all doubt being now removed, Bessel announced to the world that he had compassed the hitherto impassable gulf of space, and measured the distance to one of the fixed stars. The final conclusion deduced, confirmed by the subsequent researches of M. Peters at the Observatory of Pulkowa, assigns to 61 Cygni an annual parallax of 0".349, rather more than one-third of a second of space. This corresponds to the enormous distance of nearly 900,000 radii of the earth's orbit or as many times 91,000,000 miles. The distance of the star may therefore be set down in round numbers at *sixty billions* of miles.

The mighty gulf which separates us from the stars having been once passed, the route has been followed; and succeeding observers have determined the parallax of a sufficient number of stars to show that their results are entirely trustworthy. General dependence may be placed on the results given in the table:

Stars.	Parallax.	Distance in Radii of the Earth's Orbit.	Distance in Billions of Miles.	Observers.
1. α Centauri, - - - -	0".913	225,020	21	Henderson.
2. 61 Cygni, - - - -	0".349	599,715	56	Bessel.
3. α Lyrae, - - - -	0".261	790,297	75	Struve.
4. Sirius, - - - -	0".230	806,304	84	Henderson.
5. 1850. Groombridge, - -	0".229	913,677	86	Peters.
6. δ Ursa, - - - -	0".158	1,530,864	147	Peters.
7. Arcturus, - - - -	0".127	1,924,184	184	Peters.

To aid the imagination in forming some idea of these distances, it may be stated, that the conflagration of these stars would not be announced to us under periods varying from upwards of three years to more than a quarter of a century, for a ray of light, which darts to us from the sun in eight minutes, would require that time to travel through the space between us and them. One delicate thread of a spider's web, placed before the eye of a spectator at 61 Cygni, would hide from his view the whole orbit of the earth; and a single hair would conceal the entire solar universe! The remark of Huygens is a sober speculation, that there may be worlds in the immensity of space, which have been long created, whose light, owing to their distance, has not yet reached our globe, though still destined to come within range of the eye.

However marvellous the statement, it is strictly true, that when we gaze upon the heavens, observe the stars, and note down their positions, we are wit-

nessing and chronicling their appearances in by-gone time, and not the present aspect of the phenomena. The ray that meets the eye from the nearest sideral object brings intelligence of its past estate; and that Past includes years in relation to the front ranks of the stellar army, and ages with respect to the general body. When we reflect upon these facts, and remember that the faint nebulous clusters are far more remote from the distinct stars than they from us—that the light which manifests their presence now may have left its source when the Tudor, Norman, or Saxon race occupied the throne—we catch a glimpse of the immensity of space, and of the infinity of that Being who originated the great government of which it is the scene, and conducts it with such mystery that a sparrow falleth not to the ground without Him.

We have nothing to guide us respecting the magnitude of the stars beyond their visibility, when so vastly remote. The planet Saturn is magnified by the telescope larger than the moon to the naked eye, though 900 millions of miles distant; but instrumental power fails in giving any appreciable magnitude to the stars. It brings countless multitudes into view hid from the unassisted sight; it makes us sensible of their presence; it increases their brilliancy; but beyond this, it supplies us with no information respecting their volume and mass. The simple fact of the visibility of the stars across the mighty expanse which we know to exist between them and ourselves, necessarily gives us high ideas of their dimensions. Calculations have been made, from a comparison of the light of the stars with that of the sun, but the result can only be regarded as a rude approximation.

Sir John Herschel soberly answers the enquiry: "For what purpose are we to suppose such magnificent bodies scattered through the abyss of space? Surely not to illuminate our nights, which an additional moon of the thousandth part of the size of our own would do much better—not to sparkle as a pageant void of meaning and reality, and bewilder us among vain conjectures; Useful, it is true they are to man, as points of exact and permanent reference; but he must have studied astronomy to little purpose, who can suppose man to be the only object of his Creator's care, or who does not see, in the vast and wonderful apparatus around us, provision for other races of animated beings. The planets derive their light from the sun; but that cannot be the case with the stars. These doubtless, then, are themselves suns, and may perhaps, each in its sphere, be the presiding centre around which other planets, or bodies of which we can form no conception from any analogy offered by our own system, may be circulating."

CHAPTER XII.

NEW, VARIABLE, AND COMPOUND STARS.

When we compare the present appearance of the sideral heavens with the records of former catalogues, some stars are not to be found now whose places have been registered. There are four in Hercules, four in Cancer, one in Perseus, one in Pisces, one in Hydra, one in Orion, and two in Berenice's Hair, which have apparently disappeared from the sky. Of the eight stars formerly mentioned which were marked in the catalogue of Ptolemy, but had been lost in the time of Uigh-Beg, there were six near the Southern Fish, which have not been observed since; and, as four of these were of the third magnitude, Bailly concluded that they were really visible in the heavens in the age of Ptolemy, and disappeared in the interval between him and the Tartar prince. It is no doubt probable that apparent losses have often arisen from mistaken entries; yet, in many instances it is certain that there is no mistake in the observation or entry, and that stars have really been observed, and as really have disappeared. A star of the fifth magnitude, 55 Herenlis, in the catalogue of Flamsteed, was particularly observed by Herschel in 1781 and 1782; but nine years afterwards it was gone, nor has it since been seen. Sir John Herschel, in May, 1828, missed a star in Virgo, inserted in Baron Zach's catalogue, and was not able again to perceive it. "There are now wanting in the heavens," Montanari observed in 1670, "two stars of the second magnitude, in the stern and yard of the ship Argo. I and others observed them in the year 1664, upon occasion of the comet that appeared that year. When they first disappeared I know not; only I am sure that on the 10th of April, 1666, there was not the least glimpse of them to be seen."

On the other hand, there are some stars now in the heavens which are supposed to have only recently become visible. No entry of them occurs in the catalogues of former observers, who have registered objects of inferior magnitude in their neighborhood, and would not therefore have omitted these had they been present. Thus, a star in the head of Cepheus, one in Gemini, another in Equuleus, a fourth in Sextans, a remarkable one between β and δ Hydra, a sixth in Hercules, and several others, are not given in Flamsteed's catalogue. These are probably new, as that most accurate observer of the heavens could scarcely have omitted them. Since the year 1826 a star in the nebula of Orion has appeared; and attention has been specially called to it, owing to its having started as it were into existence in a situation which apparently strengthened the nebular hypothesis.

In addition to these changes, the occurrence of stars starting into temporary visibility, shining with great lustre, and then entirely vanishing, however unaccountable, is so well authenticated as to obtain a place in the class of unquestionable phenomena. An instance of this kind occurred in the year 380 of our era. In the neighborhood of Altair, in the constellation Aquila, a star suddenly appeared, continuing as brilliant as Venus for three weeks. Other stellar apparitions are recorded in the years 945 and 1294; but the most memorable case occurred in 1572, which we had occasion to notice in tracing the career of Tycho Brahe. The new star, which glowed with great splendor, and continued visible for eighteen months, appeared in Cassiopeia immediately under

the scabbellum or chair of the Lady. It was first caught sight of at Wittenburg on August 6th, seen at Augsburg on the 7th, observed by Cornelius Gemma on



November 6th, and by Tycho on the 11th. It formed an irregular square with three of the principal stars of the constellation, maintained the same position invariably with respect to them during the whole time of its apparition, exhibited no sensible parallax, which plainly declared its place to be in the region of the fixed stars. In the diagram, the largest star represents the stranger, with Caph above it on the left hand, Schedir a little higher to the right, and γ below.

There are now about twenty well-attested cases of these stars suddenly glowing from out the sombre bosom of infinity, shining with great vivacity for an interval, so as to be visible even in the day time through the intensity of their light, then gradually fading away, and becoming entirely extinct. We are completely foiled by these apparent temporary stellar creations. Are they worlds which, having accomplished one cycle of their existence, have had their physical structure dissolved by fire, to be remodelled? Are they thus bodies which have lain hid from terrestrial gaze by their remoteness, until some vast combustion has given them a transient visibility? It is an extraordinary fact, that within the period of the last century, not less than thirteen stars, in different constellations, seem to have totally perished, and ten new ones to have been created. In many instances it is unquestionable, that the stars themselves, the supposed habitation of other kinds or orders of intelligent beings, together with the different planets by which it is probable they were surrounded, have utterly vanished, and the spots which they occupied in the heavens have become blanks? Laplace likewise observes: "As to those stars which suddenly shine forth with a very vivid light, and then immediately disappear, it is extremely probable that great conflagrations, produced by extraordinary causes, take place on their surface. This conjecture is confirmed by their change of color, which is analogous to that presented to us on the earth by those bodies which are set on fire and then gradually extinguished."

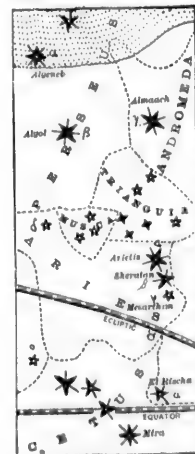
But it has been suggested, that temporary stars may be resolved into a periodical translation from the depths of infinite space, to a station which brings them within the bounds of our vision. Their sudden and brilliant burst from the dark and distant void, upon this supposition, arises from a tremendous velocity; and their evanescent stay within our view, may be caused by one of the narrow extremities of an orbit immensely elliptical lying in the direction



of our system. The diagram represents part of this supposed orbit, that which approaches our position in the universe. It is further conceived, that the temporary stars of 945, 1264 and 1572 were not different individuals, but in reality the same

star. This is grounded upon the close accordance of the intervals separating the periods. It has been supposed, therefore, that the star has an orbit which it performs in the space of about 313 years. The chief difficulty which lies in the way of the supposition, that the temporary stars are objects moving in orbits, which display them periodically to us, is, that no change of place has been observed during the whole time of apparition.

Besides cases of sudden stellar apparition and apparent extinguishment, there are a number of stars whose light undergoes a periodical increase and diminution, forming the class called *variable*. Some retire for a time into absolute invisibility, while others merely suffer changes in their brightness, without being absolutely lost to view.



The earliest observed example of this class is α Ceti, called also Stella Mira, or the wonderful star, situated in the neck of the Whale. The following are now its general phases, which are gone through in 321 days, 15 hours and 7 minutes. When at the greatest brightness, it is equal to a star of the second magnitude, and remains so for about a fortnight. It then decreases during three months, passes entirely out of sight, continues invisible about five months, again comes into view, increases during three months, when it attains once more its maximum lustre. It does not always, however, return to the same degree of brightness, or increase and diminish by the same gradations, or invariably remain invisible the same length of time. For the four years between October, 1672, and December, 1676, it was never seen at all, though Hevelius searched that part of the heavens diligently for it. On the other hand, it was unusually bright October 5, 1830, as observed by Argelander. The relative position of Stella Mira is shown in the diagram.

Algol, the name of the star β in Perseus, in the head of Medusa, is another remarkable instance of stellar mutation. It varies from the second to the fourth degree. The star goes through its variations in a remarkably short space of time:

it continues at its brightest two days and fourteen hours. Then its splendor suddenly begins to diminish, and in three hours and a half it is reduced to its minimum. Its feeblest lustre lasts but little more than fifteen minutes. It then begins to increase, and in three hours and a half more, it is restored to its usual brightness. Its full period is therefore 2 days, 20 hours and 48 minutes. The remarkable law of variation to which this star is subject suggested to Goodricke the idea of some opaque body revolving around it, which, interposing between the earth and the star, cuts off a portion of its light. Algol may be seen on any fine evening from August to May, as it continues above the horizon twenty hours out of the twenty-four. With Algenib in the side of Perseus, and Almaak in the foot of Andromeda, it forms a triangle, with the open part towards Cassiopeia.

χ Cygni changes from the sixth to the eleventh degree of magnitude, and consequently at its brightest is only visible to the naked eye under favorable circumstances. There are altogether nearly forty stars ascertained to be variable, and others suspected to belong to the class.

Various conjectures have been hazarded to account for these cases of periodic stellar change. If we suppose the varying brightness of the bodies in question to be caused by varying distance, the same hypothesis as that which has been mentioned in connection with the temporary stars, it is singular that their position should be wholly unaltered during their respective changes. This appears fatal to the idea of orbital motion being the cause of their variable appearance. Another surmise is, that dark bodies revolve around these stars, which, periodically intervening between them and us, temporarily cut off their light. Mr. Goodricke proposed this theory respecting the star Algol; but it is open to the objection that it requires us to assign a magnitude to the revolving body in relation to that which must be deemed its primary, which is out of all proportion to that which we are led to believe belongs to dependent orbits. The subservient bodies in our system are immensely inferior to their primary, the sun, and owing to this, to a distant observer of our part of the universe, the transit of the mighty globe of Jupiter across the sun's disk would produce no perceptible effect. Our knowledge of planetary motion is also adverse to that rigorous uniformity which is so marked a feature of the stellar changes.

It may appear a gratuitous assumption to take the solar system as a miniature picture of others; but we can only reason concerning what we know not, from what we know. Minute white specks appear in the neighborhood of the stars, γ Hydre, χ Geminorum, and ϵ Ursæ, which in all likelihood are their encircling planets—tributary companions—plainly and vastly inferior, according to the analogy of subservient bodies in our system. Their intervention would have no perceptible effect upon the appearance of their primaries to our vision. The most probable hypothesis that has yet been proposed to account for the examples before us of stellar changeableness is that of axial rotation. The variable stars are supposed to have parts of their surface less luminous than the rest, which, when presented to us in the course of rotation produce the periodical decay of light, and absolute invisibility observable. A variety of circumstances occur to favor this idea. Rotation upon an axis is a law to which every orb is subject, with which we are sufficiently acquainted—as the sun, the planets, and their satellites. The greatest uniformity marks the execution of the law, and in this it differs from translation in space. The planets travel in irregular paths and with varying velocities in their orbits, but their axial motion is uniform. If, therefore, one of the hemispheres of a rotating body within the sphere of vision should be less luminous than the other, periods of decay, obscurity, revival and vivacity, would be exhibited, of uniform occurrence and duration. Now, those who have paid most attention to solar phenomena are of opinion, that besides the sun having variable spots upon his disk, which at times have been so numerous and extensive as to impair his orb, there is reason to believe the illuminating power of his two hemispheres to be unequal, one being much fainter than the other. We may not be sensible of this, because, comparatively situated in immediate vicinity to his effulgence; but, removed to a vast remoteness, his rotary motion might constitute him sensibly a variable star to us.

We now proceed to notice the Multiple stars, objects very little known until a recent date. Soon after the application of the telescope to the heavens, it was perceived that some of those brilliant points, which appear single stars to the naked eye, are in reality stellar combinations comprising two or more individuals. But little attention, however, was paid to them, and no suspicion entertained of their numerical amount. The list of conjoined bodies, whose positions and relative distances have been accurately determined, now includes a number which is five or six times greater than that which appears in the general stellar catalogue of the ancient observers. Sir James South and Sir John Herschel produced a catalogue of 330 multiple stars in the year 1834, as the result of their joint labors. This was followed by one of 480 from South, and another of 5,300 from Herschel—the fruits of solitary observation. M. Struve, of Dorpat, also has registered the data of 8000. These are all included in the northern hemisphere, and within 15° south of the equator. From the southern heavens an equally plentiful harvest may be gathered, of which Mr. Dunlop's catalogue of 250, observed at Parramatta, may be regarded as the first-fruits. Upon the whole, the number of stars whose multiple character and respective positions have been determined, cannot be rated at less than 6,000. Of these the most numerous are twin-stars, or binary systems. Some of the more remarkable specimens are Castor, γ Coronæ, Rigel, Polaris, Mira, or ϵ Bootis, γ Leonis, γ Virginis, ϵ Ursæ Majoris, α Herculis, 36 Andromedæ, χ Ophiuchi, and π Aquilæ.

Of all the binary stars in the heavens, Castor is the largest and finest; the one also which has been the longest observed. Castor is a Geminorum, one of the bright stars in the head of the Twins, the most northerly of the two, and is easily separated by a moderately good telescope. Its constituents are of the

ASTRONOMY.—SCENERY OF THE HEAVENS.

CHAPTER XIII.

STAR-SYSTEMS.—NEBULÆ.

The imagination is apt to run riot, in endeavoring to picture the effect of this variety of color, to a planetary attendant of one of the suns in a binary or tertiary system. "It may be more easily suggested in words," remarks Sir John Herschel, "than conceived, what variety of illumination two suns—a red and a green, or a yellow and a blue one—must afford to a planet circulating about either; and what charming contrasts and grateful vicissitudes—a red and a green day, for instance, alternating with a white one and with darkness—might arise from the presence or absence of one or the other, or both above the horizon."

From the preceding statements it is clear, as has been previously observed, that the common term, *fixed stars*, is not rigidly applicable to the bodies so denominated. Orbital revolution is not only displayed by the constituents of the multiple stars, but there are observed instances of a *proper motion* in space common to the constituents of each. The change of place in these stars requires perfect instruments, and a lapse of years for their observation; but a real movement of great magnitude is indicated, of which we should be sensible if we were nearer neighbors to them. In the sixteenth century, Jordano Bruno, an Italian, maintained that we are not warranted in supposing the stars to be all fixed in relation to each other, since their distance from the earth is so immense as to render their motions insensible to us; and he remarked that it could only be decided after a long course of observation, whether they revolved around each other, or what other movements they might have. Hooke, in the following century, surmised the improbability of the stars being absolutely fixed with respect to each other, and suggested that not only might these bodies be in a state of continual motion, but the whole solar system likewise. But Halley is the first person who, from observation, suspected the proper motion of the stars. In a paper of the year 1718, he stated, that since the days of the Alexandrian astronomers, the stars Aldebaran, Arcturus and Sirius, must have slowly advanced to the south. A few years later, J. Cassini demonstrated, by the most conclusive evidence, that Arcturus had sensibly shifted in latitude since the time of Tycho Brahe. Bradley soon afterwards remarked, that the apparent motions of the stars might arise either from a movement of the solar system in space, or from a real change in the positions of the stars themselves; but he avowed the opinion, that many ages must elapse before it would be possible to come to a definite conclusion on the subject. In 1750, the remarkable "Theory of the Universe," published by Wright, assumed the motion of the solar system in space, as well as that of all the stars of the firmament.

At last, in 1783, Herschel addressed himself to the resolution of the great problem, by forming a catalogue of stars situated in all parts of the heavens, in which an appreciable amount of proper motion had been detected and measured. After an extended examination of the subject, Herschel announced his belief that a part of the proper motion of the stars must be attributed to the effect of systematic parallax, or to the movement of the solar system itself; and that this movement is directed towards a point in the heavens somewhat to the north of the star γ Hercules.

This theory was not supposed in general by the astronomers of the day to be founded on well-determined observations. It was received, therefore, with hesitation and doubt; it fell into dispute; and Herschel died before any confirmation of it had been obtained. But the later researches of Argelander, Lundahl, Otto Struve and Peters, on the stars of the northern hemisphere, combined with those of Mr. Galloway on the stars of the southern sky, have demonstrated, in the most undeniable manner, not only the fact of the solar motion, but its direction, in close agreement with Herschel's announcement, and its rate.

What are the stars made of? Fifty years ago, or less, if such a question had been proposed to any chemist, naturalist or astronomer, it would have elicited a look of surprise, if asked with seriousness, at the simplicity of the party in supposing that any information upon the subject could be supplied. Nor at that period would any chemist, naturalist or astronomer, have deemed it feasible to entertain the expectation that science would ever arrive at any certain knowledge of the materials of which the orbs of heaven are composed. But we know this now, at least to some extent, in relation both to the sun and to the stars. So rapid of late has been the march of physical discovery, that it is not a vague speculation or random guess, but an absolute certainty, that terrestrial elements with which we are very familiar are substances which enter largely into the composition of "Arcturus with his sons," and the "bands of Orion." The spectroscope has been the means of revealing this interesting fact.

The spectrum of the brightest of the stars is of course very much less brilliant than that of the sun. Still, when a powerful telescope, armed with a spectroscope of sufficient power, is directed to a conspicuous member of the stellar host, as Aldebaran for example, or Vega or Capella, the rainbow-tinted streak of light distinctly flashes out to view, and presents its dark lines, indicating these stars to have a constitution resembling that of our sun, or to be self-luminous orbs, surrounded with an atmosphere of absorptive vapors. The atmosphere of Aldebaran comprises, in a state of vapor, enormous quantities of iron, mercury, bismuth, antimony, magnesium, sodium, calcium and hydrogen. In that of Sirius, and many of the white stars, the presence of hydrogen is very decidedly shown by the spectrum being crossed by the intensely strong lines which correspond to the element, while the metallic lines are remarkably faint. On the contrary, the lines of hydrogen are wanting in the spectrum of Betelgeuse, the brightest orb of Orion, while the presence of iron, sodium, magnesium, and other elements is very definitely indicated. Thus, by analyzing the stellar light, the spectroscope has in effect brought us intelligence from the stellar orbs, across spaces to be measured only by millions on millions of miles, which declares them to be, as it were, bone of our bone, and flesh of our flesh, united to our tiny world by the bond of common physical constituents.

Far more astonishing than any of the details upon which we have hitherto dwelt, are those relating to the class of celestial objects we have now to consider, the investigation of which is at present the highest branch of practical astronomy. In directing our attention to them, we leave what may comparatively be called home regions, strange as the phrase appears, when we recollect the distance intervening between us and the nearest of the stars. But such language is strictly appropriate with reference to the stars visible to the naked eye, and reached by ordinary telescopic aid. They form our firmament or cluster, near the centre of which the solar system is supposed to be situated. Yet besides this province with which we are connected, incalculably vast as it is, perfectly inestimable both in length, breadth, depth and height, there are other provinces within view, equally as capacious, distinct firmaments or clusters, scattered through those territories of the universe that are accessible to our gaze; and could we be removed to any of them, the whole of that great scheme of existence apparently circumscribed by the Milky Way, might seem compressed into a small globular patch in space, or sprawling spot, only to a trifling extent bedimming the azure of the heavens—the aspect presented by these star-systems, clusters, or nebulae to ourselves.

It is a reasonable supposition that stars which are classed as belonging to the inferior orders of magnitude, only appear to be so generally, because of their greater distance. Now it is observable, that the most brilliant, or those of the first, second, and third magnitudes, are pretty evenly distributed over the surface of the heavens; but those of the fourth, fifth, and sixth magnitudes appear in crowds towards the margin of the Milky Way, while that remarkable zone of light is plainly demonstrated to be an enormous aggregation of minute stellar objects, very expressively characterized as "star-dust." Hence the suspicion naturally arose, that there was some connection between the Galactic circle and the other portions of the heavens, so that the whole might form one great system. So far, therefore, from being fortuitously dispersed through space, as was once supposed, the stars forming our firmament are definitely arranged; and the particular shape of the whole mass or cluster, as it would appear to spectators in remote clusters, has been examined and approximately sketched. The whole visible creation of stars is conceived to form a stratum or layer, extending to an immense but limited distance, and thin, in proportion to the length and breadth. If our position, therefore, is towards the central regions of this stratum, we shall obviously see a great gathering of stars, agglomerated into one mass, looking towards the elongations, forming an appearance unanswerable to that of the Milky Way; but looking towards either of the surfaces of the stratum, we shall see a far lesser number of stars, appearing also more distinct and scattered, answering to the aspect of the other parts of the heavens. Supposing likewise the stratum, on one side, to be split down the middle, the appearance in that direction will be that of the Milky Way, divided through a certain extent into two branches. The diagram may help to illustrate this view of the architecture of the visible stellar universe, the small circle indicating the place of the solar system in it.



We thus pass from the grand idea of an individual sun or star, with attendant planets, forming a solar system, to the incomparably grander conception of a vast mass, cluster, or universe of solar systems, many perhaps surpassing our own in magnitude, and doubtless held together in definite arrangement and unbroken harmony by the bond of gravitation. Yet this stellar scheme, mighty as are its dimensions, is but a sample of the contents of celestial space—a single member in a numerous family of similar sidereal assemblages, within hail of the modern telescope. These remote groups, a few of which may be detected by the naked eye, are generally spoken of collectively as *nebulae*, from their cloud-like appearance, a denomination applied to them long before their real character was known or suspected. They vary considerably in shape, size, and luminosity; and occur in numbers, which every improvement of the telescope increases. More than 4,000 have now been observed and catalogued.

Taking a favorable night in the spring or autumn, a practised eye may discern a feeble speck between γ and ϵ Hercules, two stars of the third magnitude north and south of each other, in that constellation γ being about 22° nearly due west of Vega. Employing a common telescope, it assumes the appearance of a small and faint cometary body, of a globular shape; but using an instrument of first-rate power, it resolves into a mass of stars, whose number must be enormous, but apparently so closely wedged together, owing to their remoteness as to present the little indivisible streak of light which is scarcely perceptible

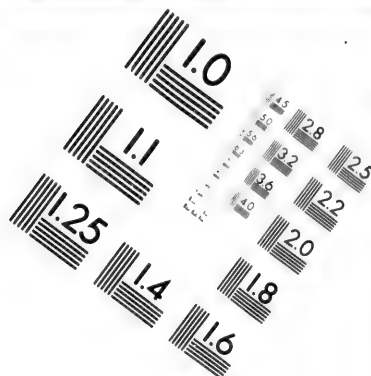
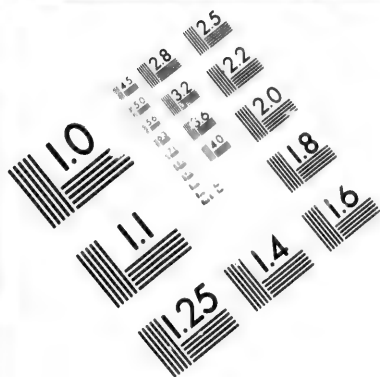
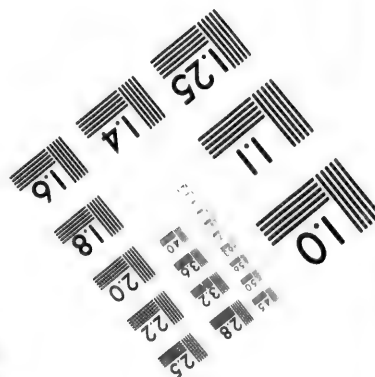
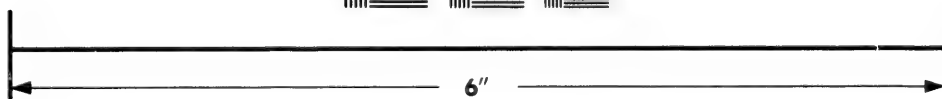
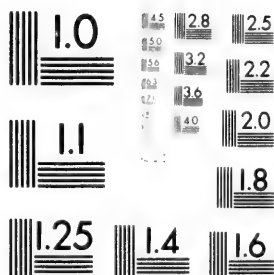


IMAGE EVALUATION TEST TARGET (MT-3)



Photographic
Sciences
Corporation

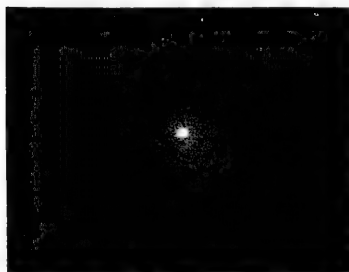
23 WEST MAIN STREET
WEBSTER, N.Y. 14580
(716) 872-4503

15
28
32
25
22
20
8

10

ASTRONOMY.—SCENERY OF THE HEAVENS.

without optical aid. The cut represents this object as seen in a reflector of 18 inches aperture, and 20 feet focal length. It is impossible, says an assiduous observer, to give a fitting representation of this magnificent cluster. Perhaps no one ever saw it for the first time through a large telescope, without



Nebula in Hercules.

uttering a shout of wonder. The heavens, as seen from a sun of this astral system, near its centre, must present a most gorgeous appearance. In all directions, innumerable stars of all magnitudes will be seen, forming a spectacle such as would be presented by our heavens, in case the Milky Way were expanded to cover the entire celestial sphere. Such spherical stellar clusters are common, the individuals of each being no doubt separated from one another by as wide a gulf as that which exists between our sun and the nearest star, their apparent contiguity and compression to us arising from their immeasurable distance.

It is inferred from the appearance presented by many clusters, that the components of each are bound together by mutual relationships, and constitute a particular assemblage of stars governed by internal laws peculiar to itself, though corresponding generally with those which prevail in other sidereal systems. The common occurrence of the globular shape, and of great central condensation, the light there running up into an unbroken blaze, may perhaps be accepted as evidence of the attraction of gravitation. It is striking to catch a glimpse of a law with which we are so familiar—the law that unites the atoms that compose the earth—in prevailing operation millions of leagues away from our terrestrial residence, binding together in spherical masses whole sidereal systems. Such a fact, however, commonly suggests no further remark



Sir John Herschel.

CRAB CLUSTER.

Lord Rosse.



Sir John Herschel.

DUMB-BELL CLUSTER.

Lord Rosse.

than that the laws of nature everywhere prevail, and with this, thought in general ends. "But what," says Paley, "do we mean by the laws of nature, or by any law? Effects are produced by power, not by laws. A law cannot execute itself. A law refers us to an agent." These sidereal aggregations are generally round in form, with distinct appearances of gradual central condensation. One of the more remarkable, a somewhat dif-

ficult object to resolve, appears as a spot of cloudy light in the sword-handle of Perseus. But sufficient optical aid discriminates its stellar components, and discloses to view a grouping together of an immense number of stars, with a circlet of brighter individuals towards the centre.

But the globular form, though common, is by no means unvarying. There are oval shapes, while some are of very irregular outline, and present a fantastic appearance. In Canes Venatici a cluster appears which has been called the ghost of the planet Saturn, as seen with his rings in a vertical position. But the same scheme of stars presents a strikingly different aspect according as it is viewed with inferior or more powerful instrumental means. Illustrative representations are annexed of the Crab Cluster in Taurus, and the Dumb-bell cluster in Vulpecula et Anser, as seen in the telescopes of Sir John Herschel and Lord Rosse.

Here we have firmaments or clusters, insulated in space, each constituting a sidereal family equal to that to which our sun belongs.

It follows, therefore, that our firmament is but one of a series, and probably one of the smaller chambers in the great mansion of the universe. All the stars and constellations that shine in the midnight sky, constitute a stellar scheme which is but a unit of a countless number. As seen from the faint objects we discern in the side of Hercules or the sword-handle of Perseus, our whole sphere would be compressed into a small streak of light, and appear in space like a snow-flake in our atmosphere! We may conclude, however, that as the firmament, which the unaided eye of man surveys, is but a member of a vast family of systems which his assisted vision scans, so that family may be no more than as a drop to the ocean, a grain of sand to the mass of the globe, compared with what lies beyond the bounds of telescopic sight, hid in regions which mortal gaze will never explore or visit. Suppose we could actually travel across the space through which the terrestrial eye can penetrate, and take our station at the point which is now the limit of vision, would there not be a territory lying before us, equal to that we should have left behind, in the number, grandeur, and variety of its works? That the Divine capability has operated no further than where a limit is put to human investigation—that the length and breadth of the Divine dominions have been surveyed, when we have arrived at a point which we cannot pass—it were folly and presumption to imagine. That part of space beyond which the art and genius of man fail to conduct his glance, simply reminds us that we are finite beings, and have reached the limit which at present circumscribes finite powers.

We now proceed to notice another class of objects in the heavens, similarly cloud-like in appearance with the preceding, but of a totally different constitution. It was formerly supposed that all nebulae were aggregations of stars; and though many resisted every effort made to detect a true stellar composition by separating the components, this was thought to be entirely owing to their extreme remoteness from the earth, and the want of sufficient instrumental power. There can be no doubt of the truth of this surmise in a multitude of instances, or that there are star-clusters at such an enormous distance that they just loom into view, but refuse to render up to us the secret of their construction, and will never appear otherwise than as faint cloudlets to the eye of man. But of late years the surprising result has been made known by the application of the spectroscope to these objects, that some of the brightest, probably situated at distances far within those at which the true star-systems are placed, have no solid or liquid matter, but are masses of luminous gas, indicated to be nitrogen and hydrogen.

The longest known of these strange and mysterious nebulosities, supposed also to be one of the nearest, appears in the girle of Andromeda, and has been called "the transcendently beautiful Queen of the



Nebula in Andromeda.

nebulae." It is visible to the naked eye in the absence of the moon, and has often been mistaken for a comet. This nebula is of a lenticular shape, when viewed with small telescopes, but all regularity of outline is lost when those with large apertures are used. It then appears intensely bright, but the light on one side is suddenly interrupted by a dark space, after which the hazy light recommences, but is again cut off by an obscure void. Many minute stars appear to be projected on the face of the nebula; but these may be only points of light indicating denser portions of the nebulous matter. This object forms nearly a right-angled triangle with Almach and Mirac, the two principal stars in Andromeda. It may be caught by a good eye on a favorable night by projecting a line from Sheratan, the second star in

Aries, through Mirac, to about $4\frac{1}{2}^{\circ}$ beyond. It is about half a degree long, and from $15'$ to $20'$ broad.

While generally exhibiting tolerably defined shapes in the depths of space, some of the more considerable nebulae have a strangely irregular aspect and outline. This is especially the case with reference to the great nebula of Orion, one of the most extraordinary objects in the heavens, for its great extent, inequalities of light and shade, and capricious form. It occurs in the sword-handle of the figure which forms the constellation; and a good eye may discern it without the assistance of a glass. This nebula, as discerned by the naked eye, exhibits an indefinite, foggy appearance. It is brighter, more diffuse and strange, when telescopic is used; but the whole light and power of Herschel's forty feet reflector could not resolve it into distinct stars. It seems composed of little flocky masses, or wisps of cloud, adhering to some small stars at its outskirts, and enveloping one with an atmosphere of considerable extent. From a comparison of the descriptions and drawings of this object, since the time of Huygens, great alterations might be inferred. But astronomical delineation was not then sufficiently advanced to render the diagrams at all satisfactory, nor were the instruments sufficiently powerful. The first rigidly accurate representation of it is that by Sir John Herschel, which justifies its familiar name, that of the Fish's Mouth, as it certainly resembles the head and yawning jaws of some monstrous animal, with a kind of proboscis running out from the snout. The great Nebula in Orion has been decisively shown by the spectroscope

to be a vast mass of luminous vapor, glowing even to incandescence amid the intensity of cold supposed to pervade all open space. A large number of exceedingly minute red stars are apparently connected with certain parts of the filmy material, probably not of the same nature as the real stars, but points rendered more luminous by an increase of density. The apparent superficial magnitude of this wonderful object is equal to three or four times that of the moon's disk. Its absolute dimensions must therefore be enormous. Supposing it at the distance of a star of the eighth magnitude, its size must be at least 5,208,000,000,000,000,000, or more than five trillions of times that of the sun.

Among the aspects under which nebulae appear, one of the most startling is the spiral or whirlpool form delineated in the annexed representations. But this conflagration belongs to many of the true star clusters, as well as to the objects which are only known to us as irresolvable cloudlets. Other examples are of circular or oblong shape, which often show decided symptoms of central condensation, giving them the appearance of stars surrounded by extensive hazy atmospheres, while the frequent arrangement of

the real stars in pairs is repeated by duplicate nebulae. In numerous instances, the patches of cloudy light have no tolerably defined outlines, being out into and pierced through by deep holes or clefts; and also drawn out into long wisps and streams, thinning away into invisibility. Two very remarkable objects, well known to mariners, being visible to the naked eye, distinguish the southern firmament. They are cloudy masses of light, called Nebula Major and Minor, greater and lesser cloud, but familiarly referred to as the Magellanic clouds after the navigator, Magellan, who was one of their first European observers.

The existence of a gaseous substance extending over immense regions of space, self-luminous and highly phosphorescent, may now be accepted as a well established fact. If regarded as a kind of rudimentary material out of which "the worlds were made," and systems are still forming under control of slow and silently conducted processes of mechanical union and chemical combination, no uneasy feeling need disturb religionists, as was the case when the nebular hypothesis was first broached as though based on atheistical principles. It is an entire misconception to suppose that it substitutes growth for creation and puts material necessity in the place of Eternal Providence. In inferring that the solar system has been formed out of a nebulous mass by the gradual operation of physical laws, there is a Supreme First Cause, by whose will those laws were appointed, and by whose power they are influential, as necessarily implied as in the contrary supposition that the whole frame-

work of the solar universe, perfect in all its parts, was called into existence by the divine volition in the twinkling of an eye. Why should gravitation be an attribute of matter? Why should change occur in the disposition of material constituents? Why should a diffused, gaseous, and luminous nebula condense, and become in the sweep of ages a solid globe, adapted for the sustenance of animal life, and the gratification of intellectual natures? Or why should there have been a primordial condition, the formless void of sacred writings,

the chaos of ancient nations, endowed with wondrous properties of entering into new combinations? The answer to these questions refers us to an intelligent and omnipotent Being whose free choice originated the germinal elements, placed them under the action of laws adapted to accomplish His designs,

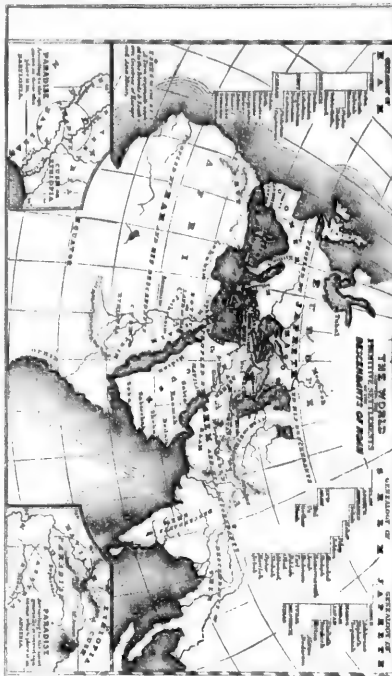
and those laws are simply the tools with which He is pleased to work. They are dependent and not self-acting powers. They are links in the chain of casual influences, but not the first links of the series.



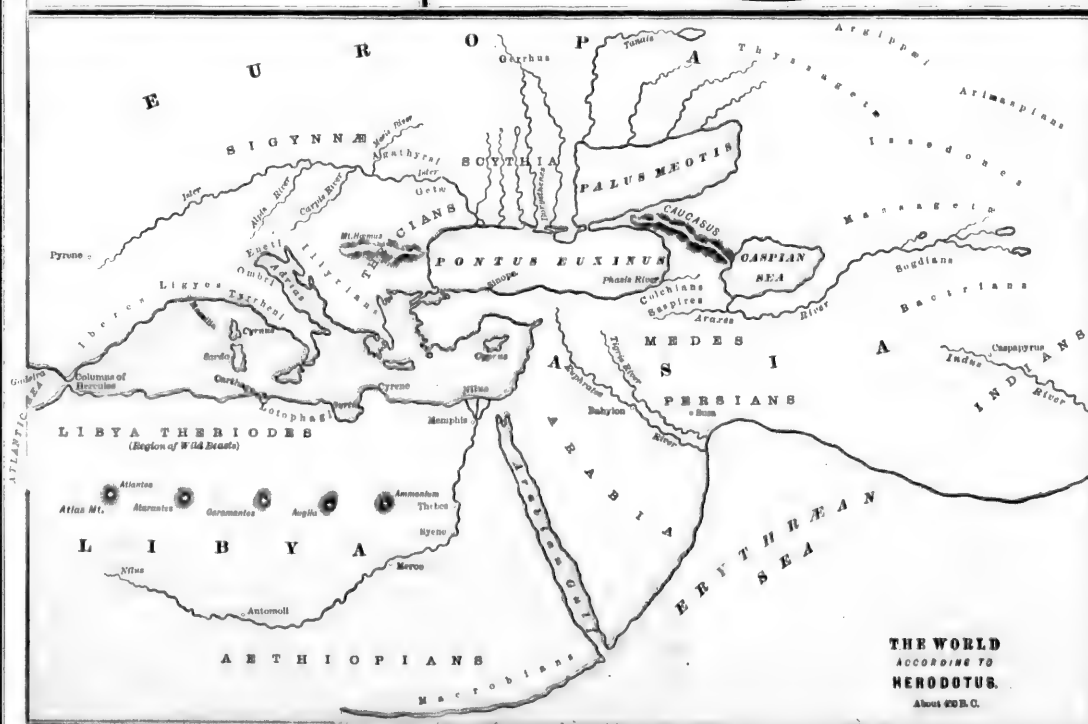
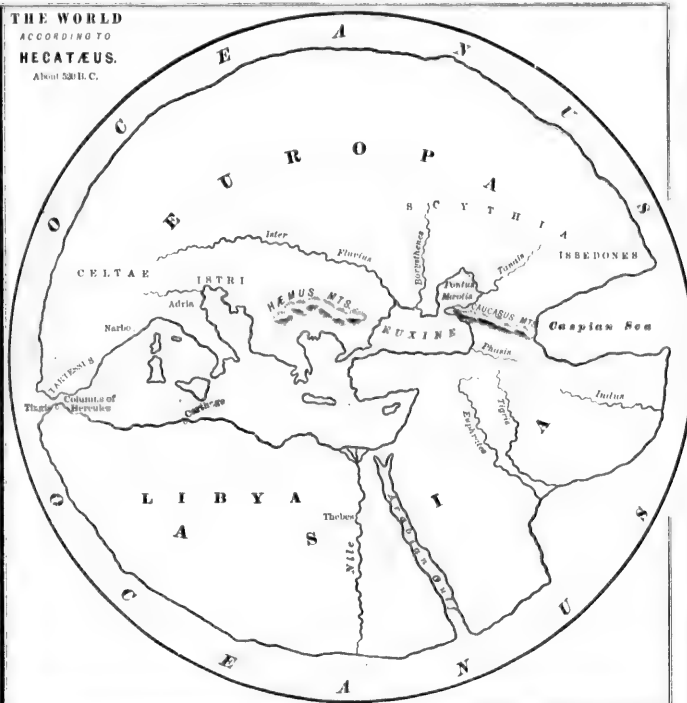
Spiral Nebula.



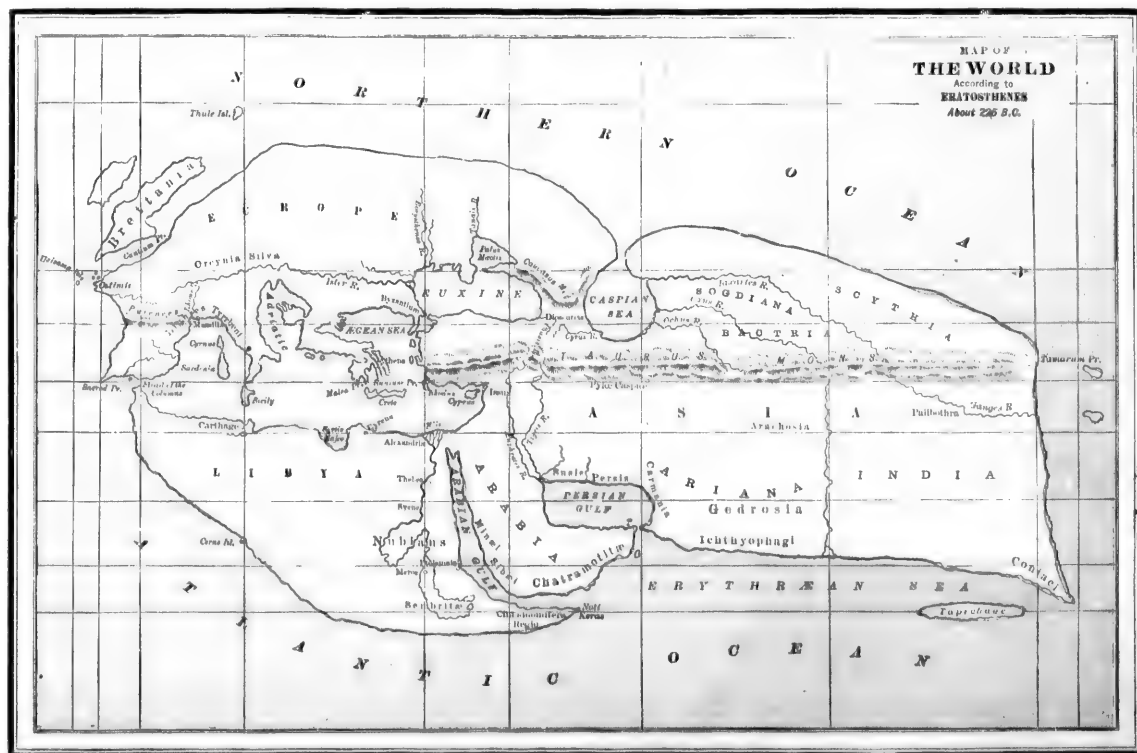
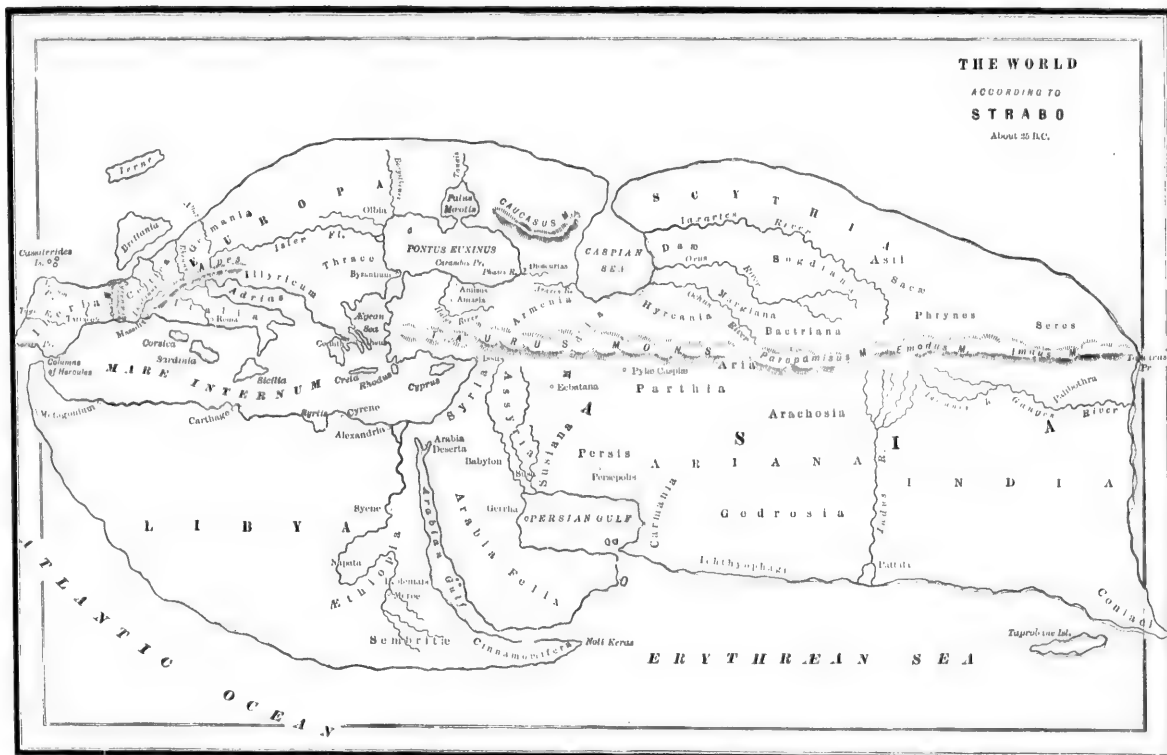
Binary and Double Nebula.

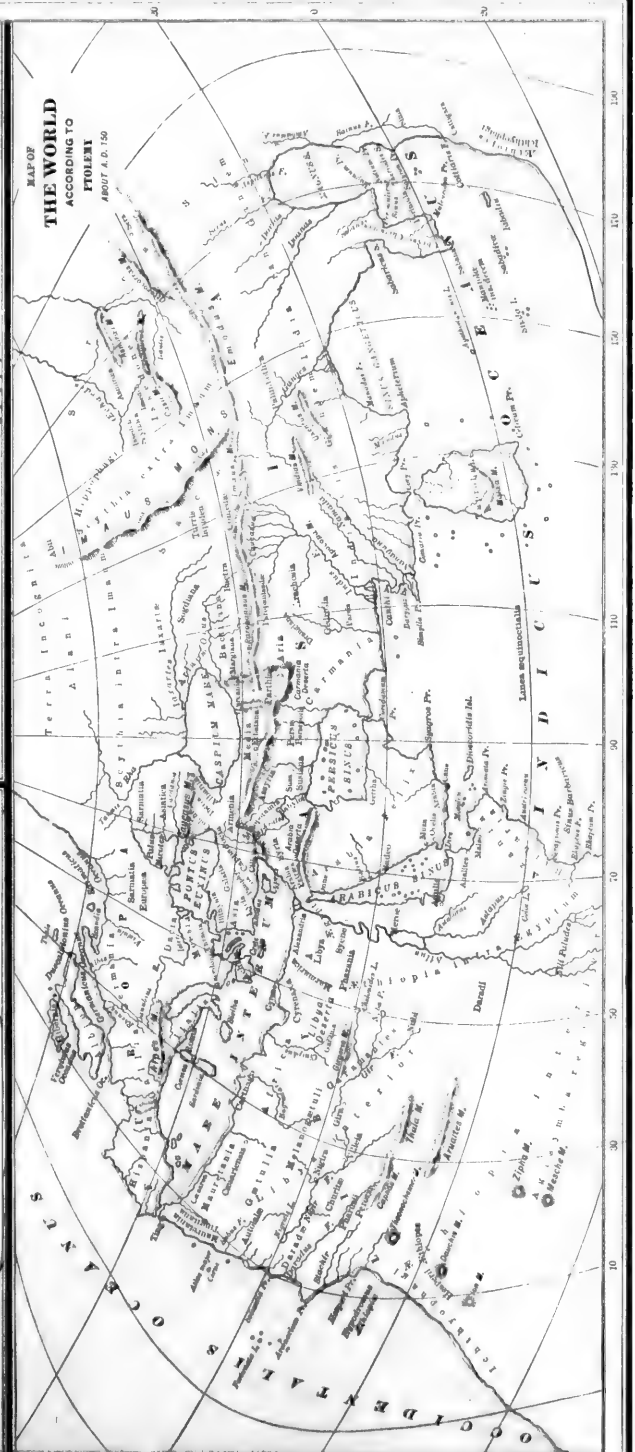
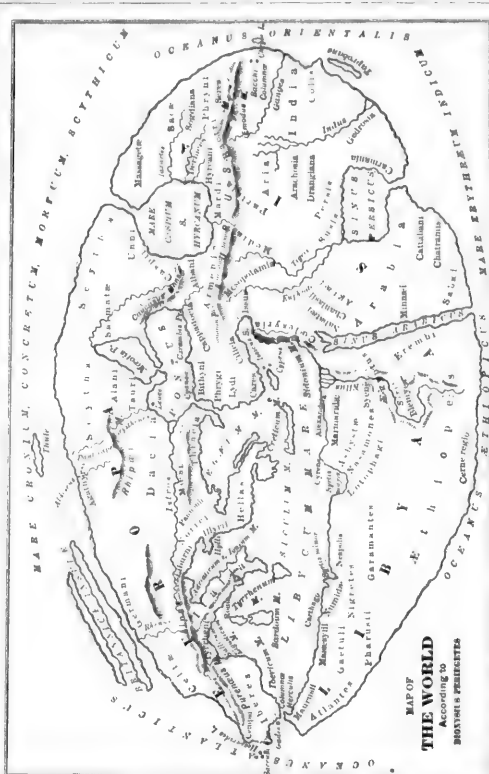
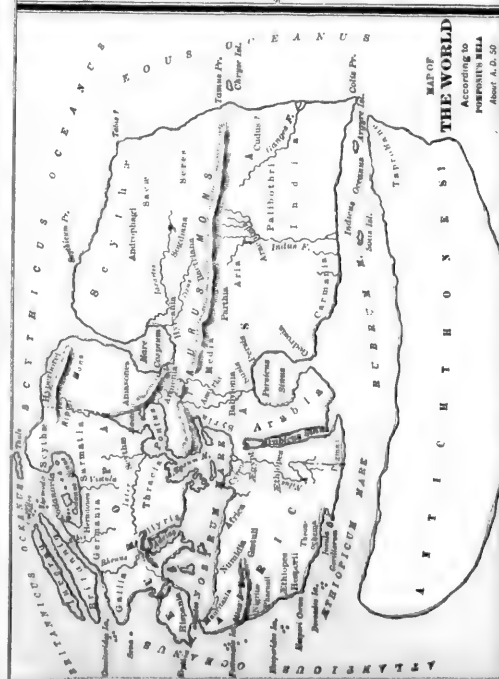


THE WORLD
ACCORDING TO
HECATÆUS.
About 500 B. C.

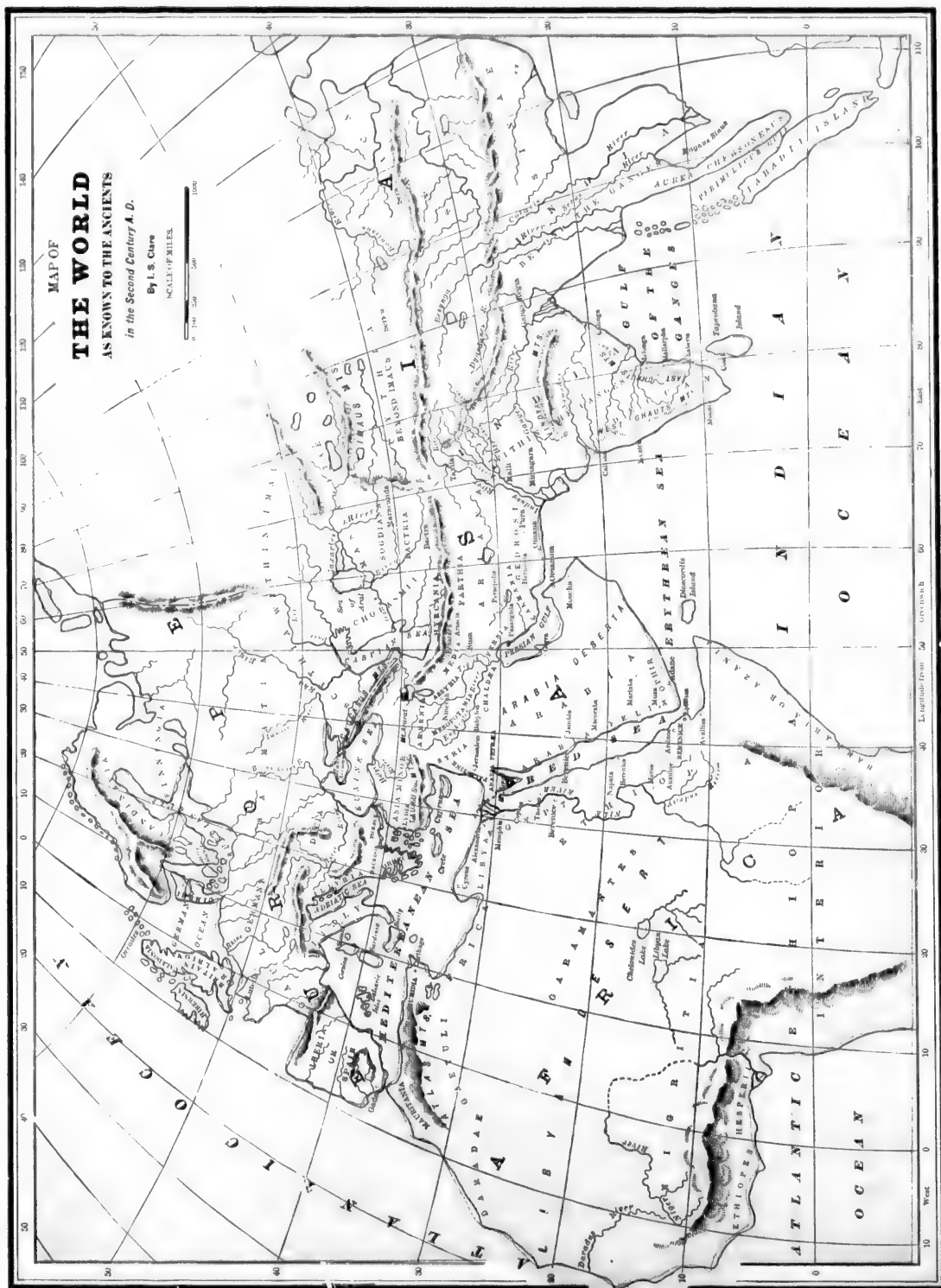


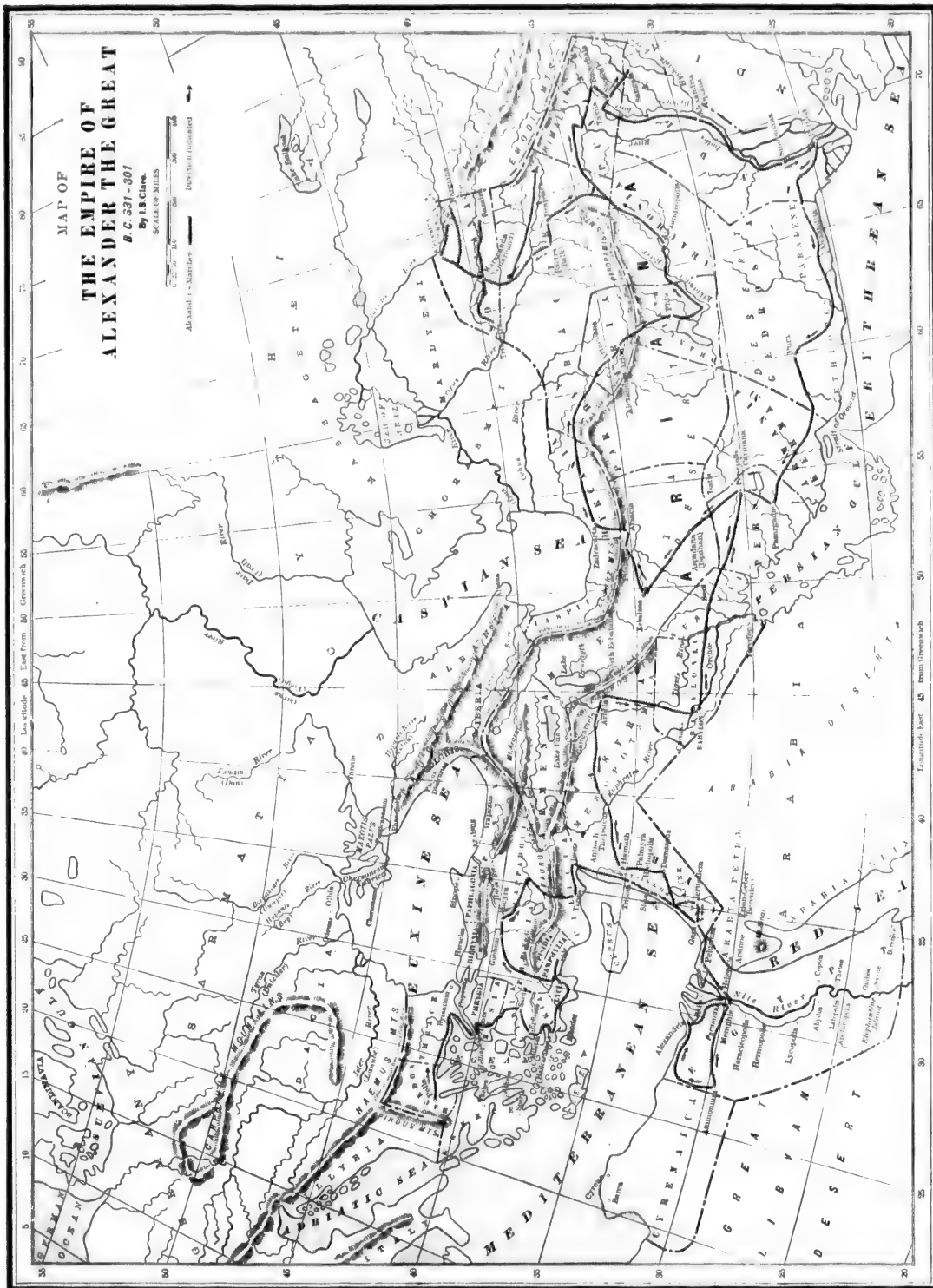
THE WORLD
ACCORDING TO
HERODOTUS.
About 450 B. C.

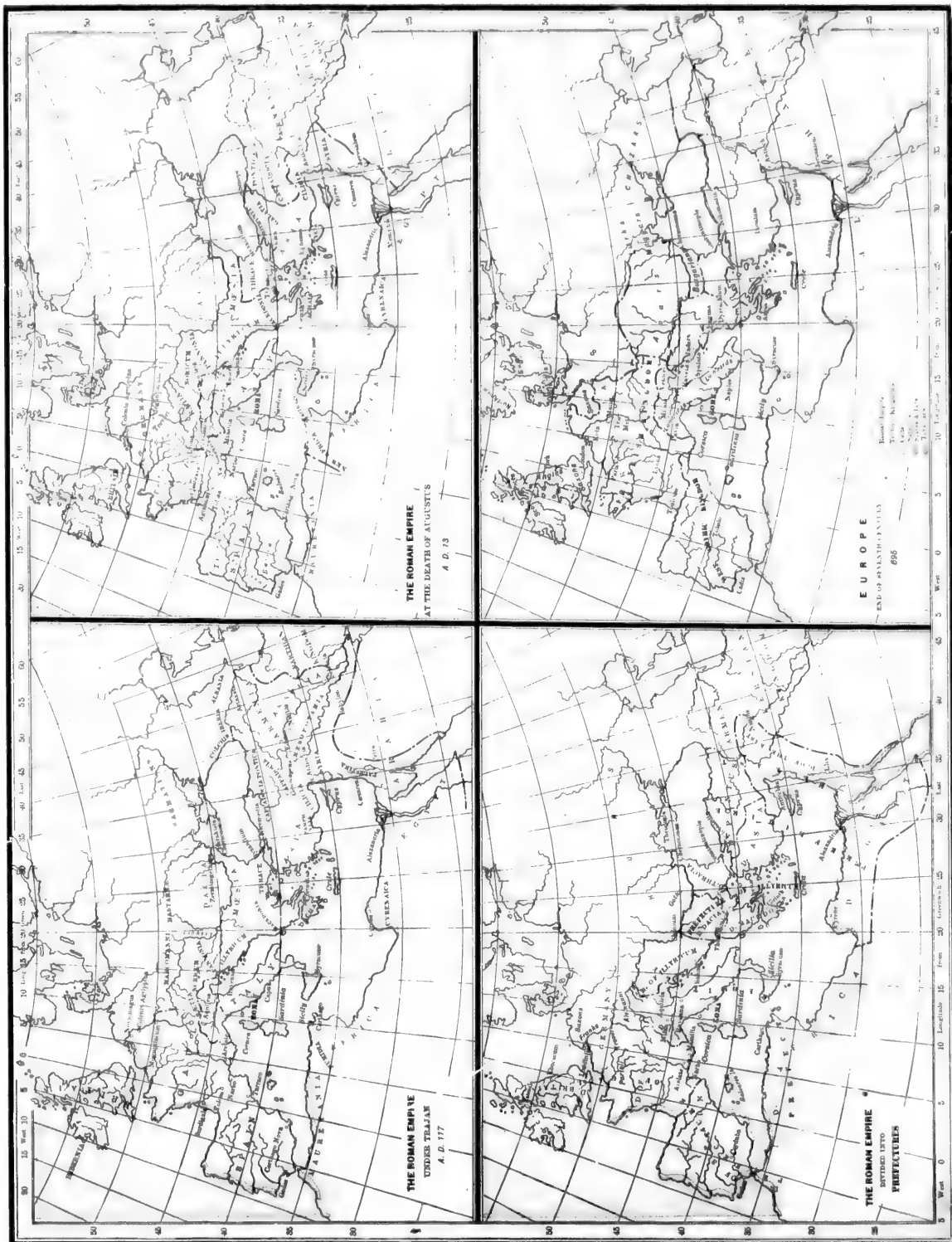


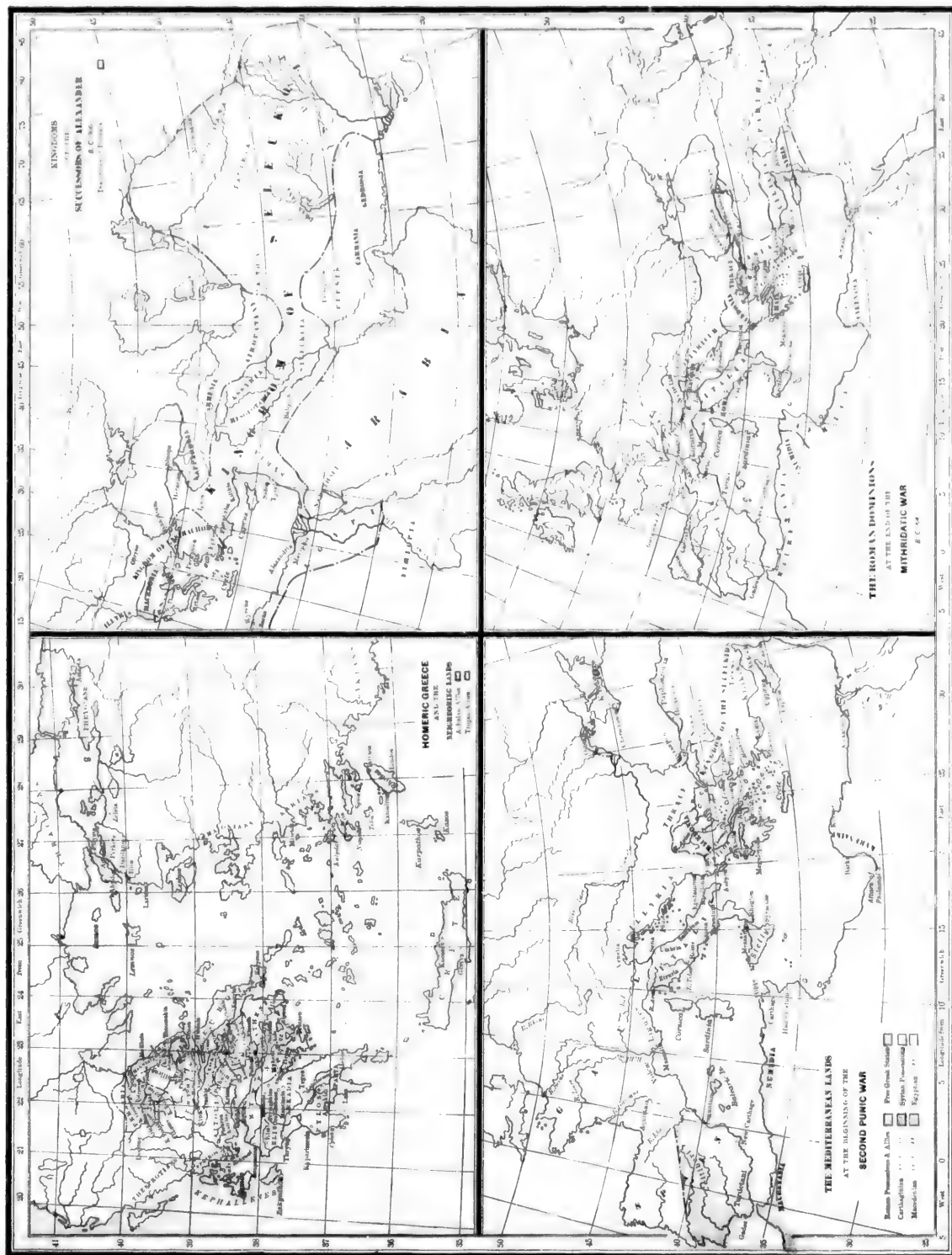


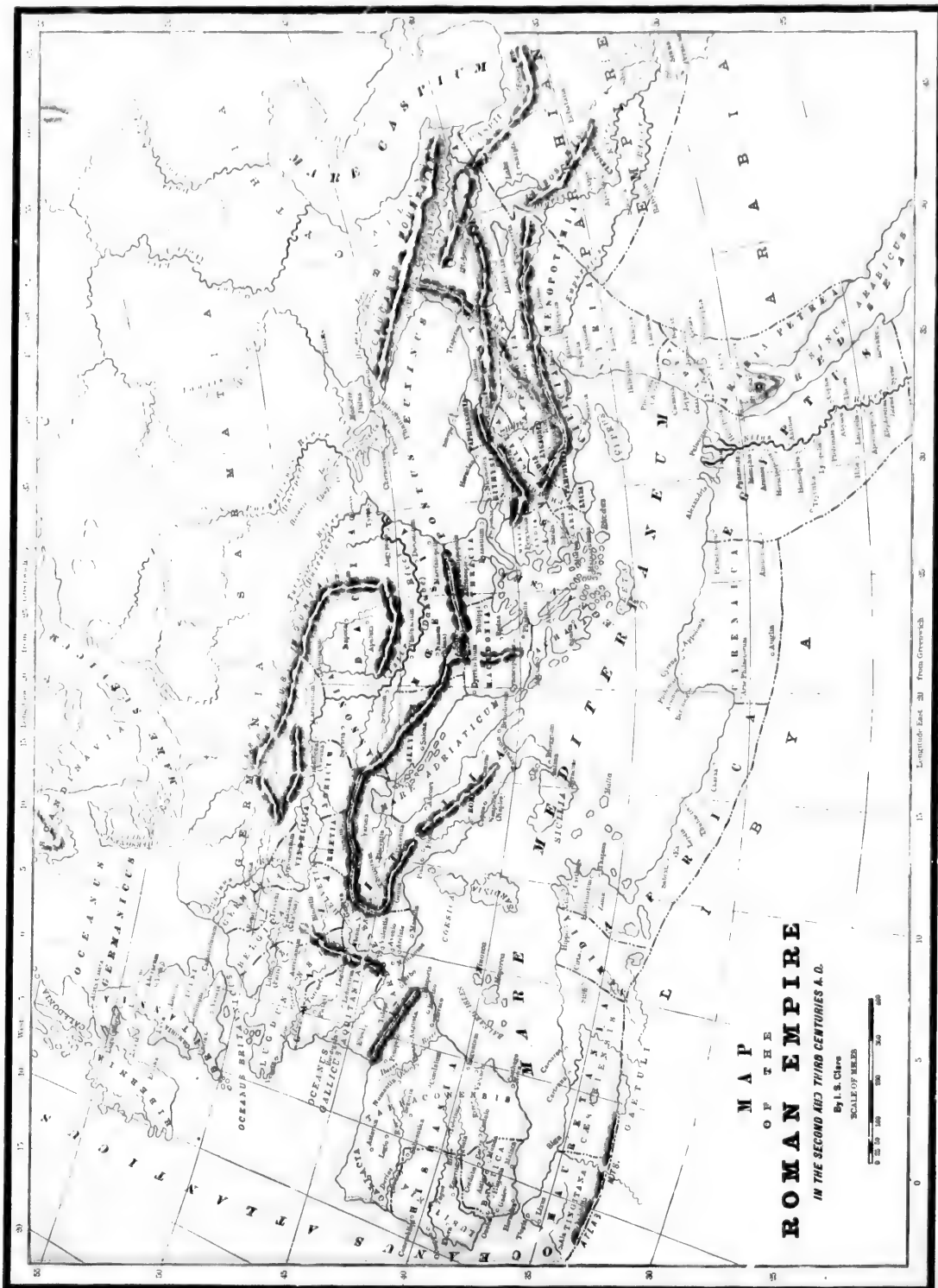


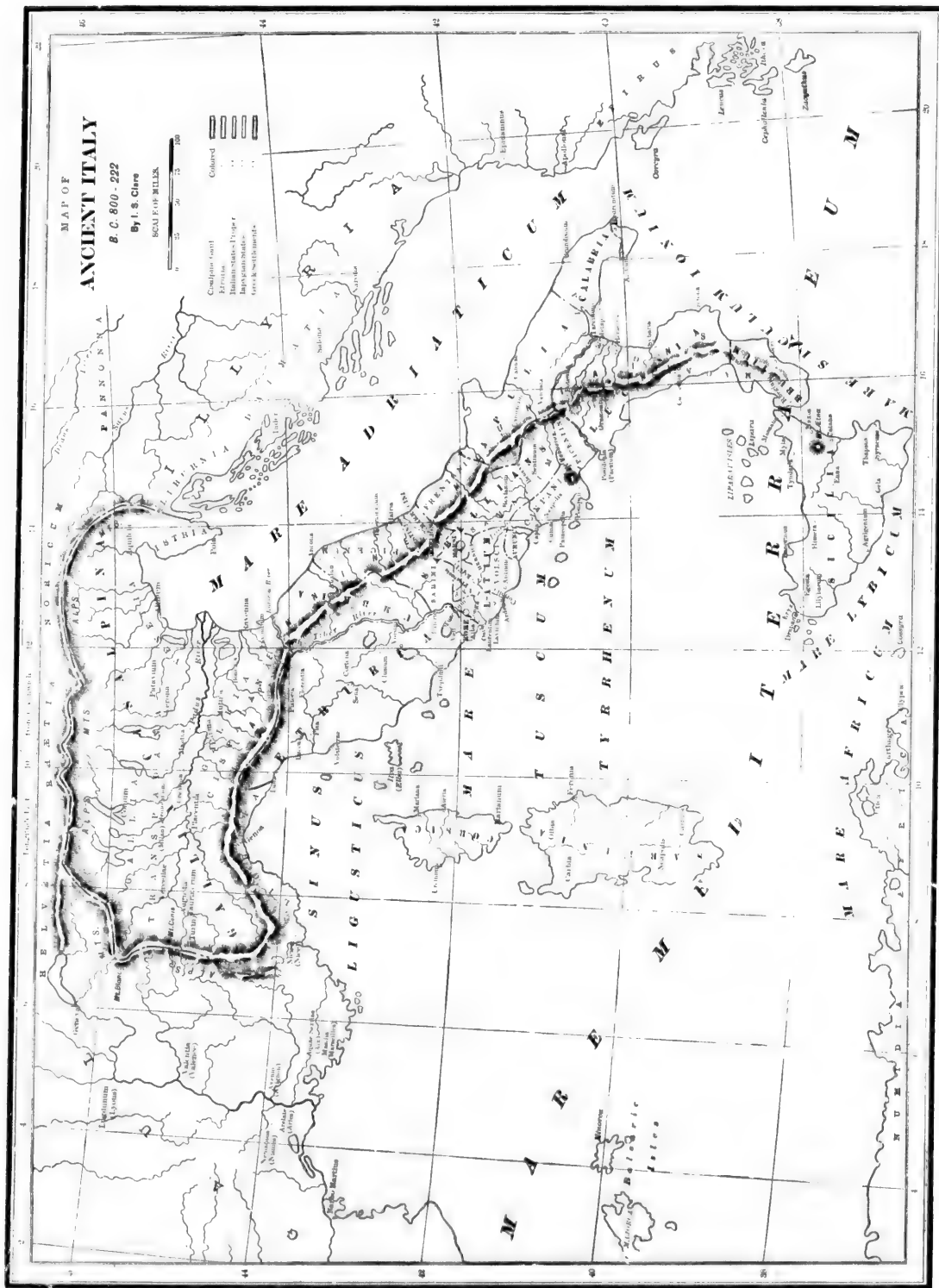


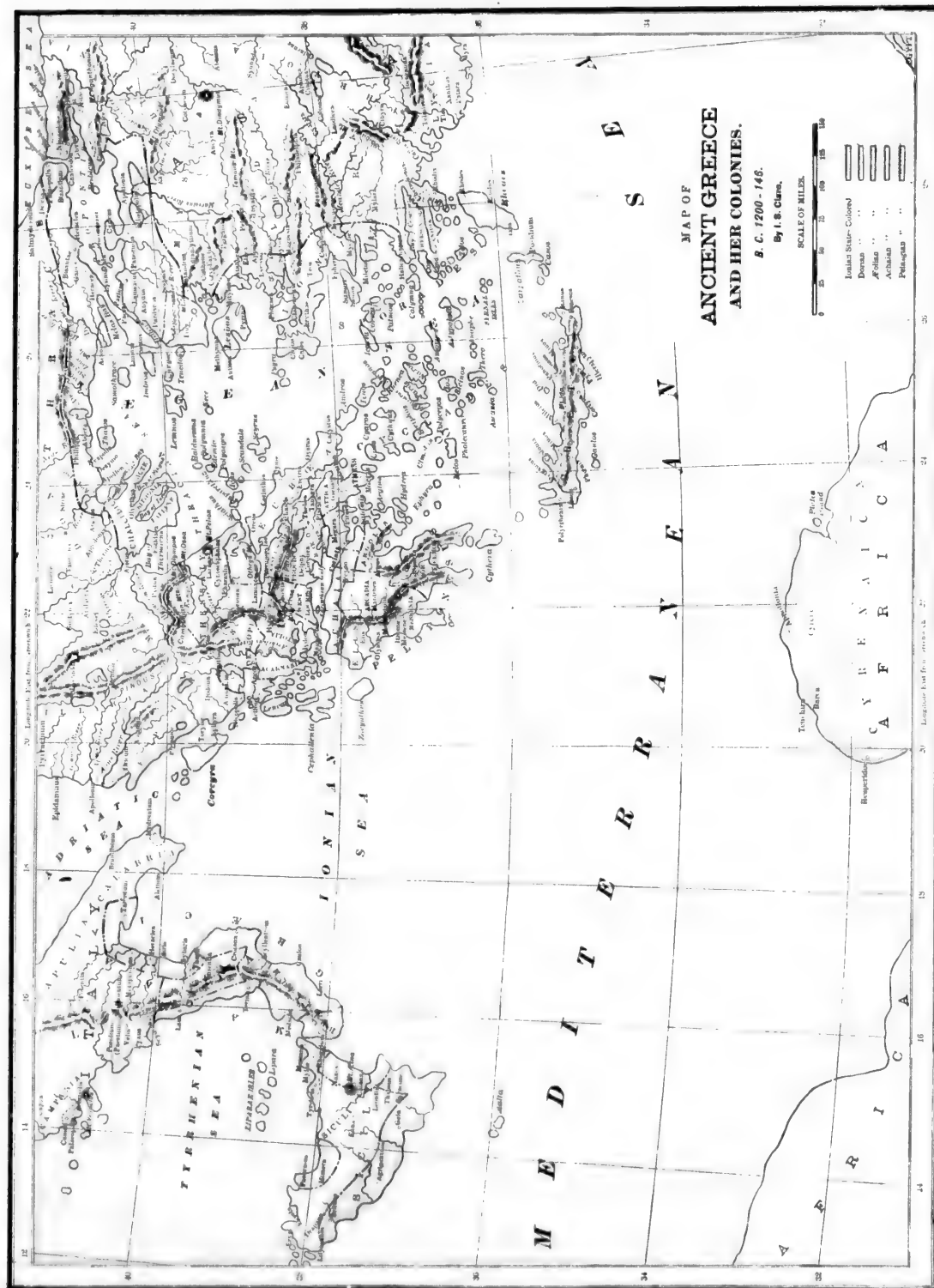


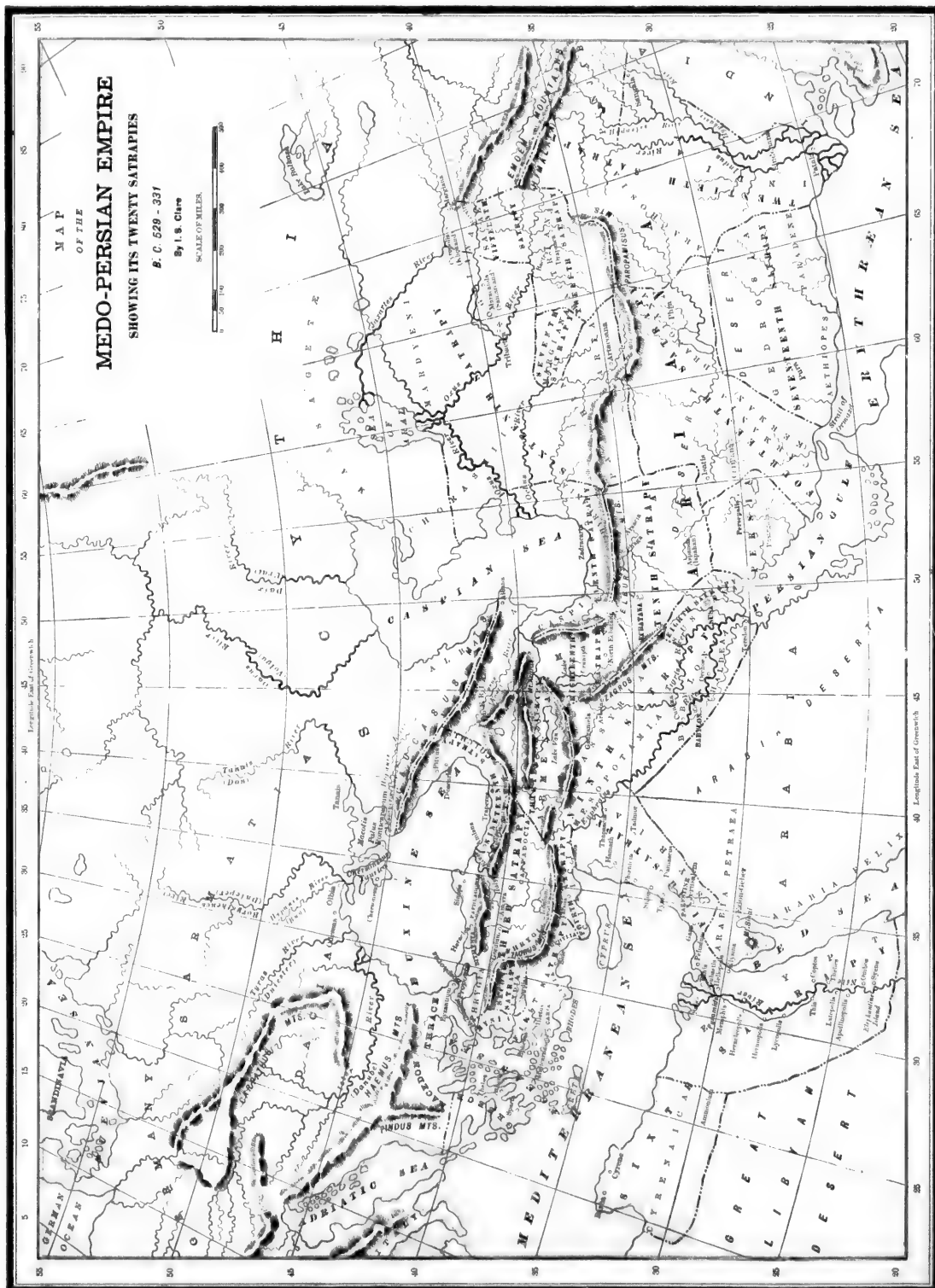


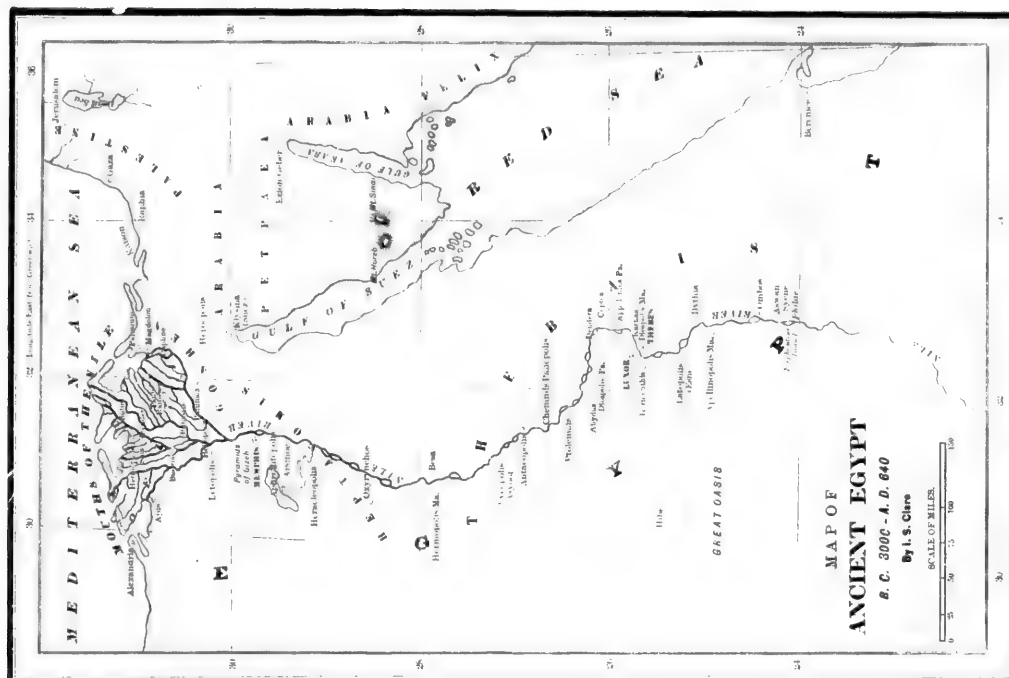
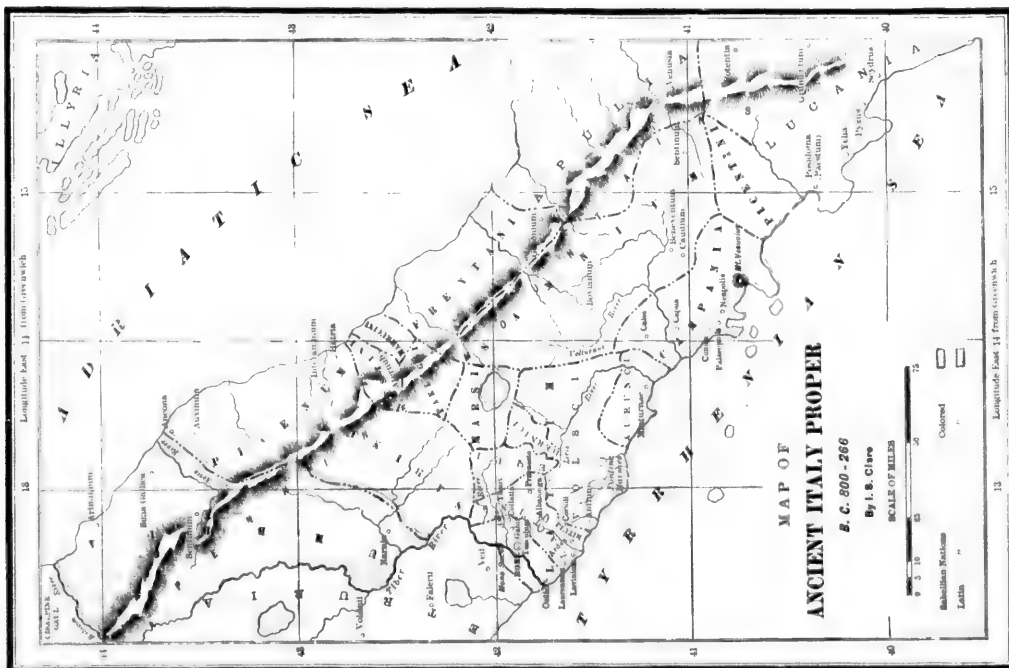


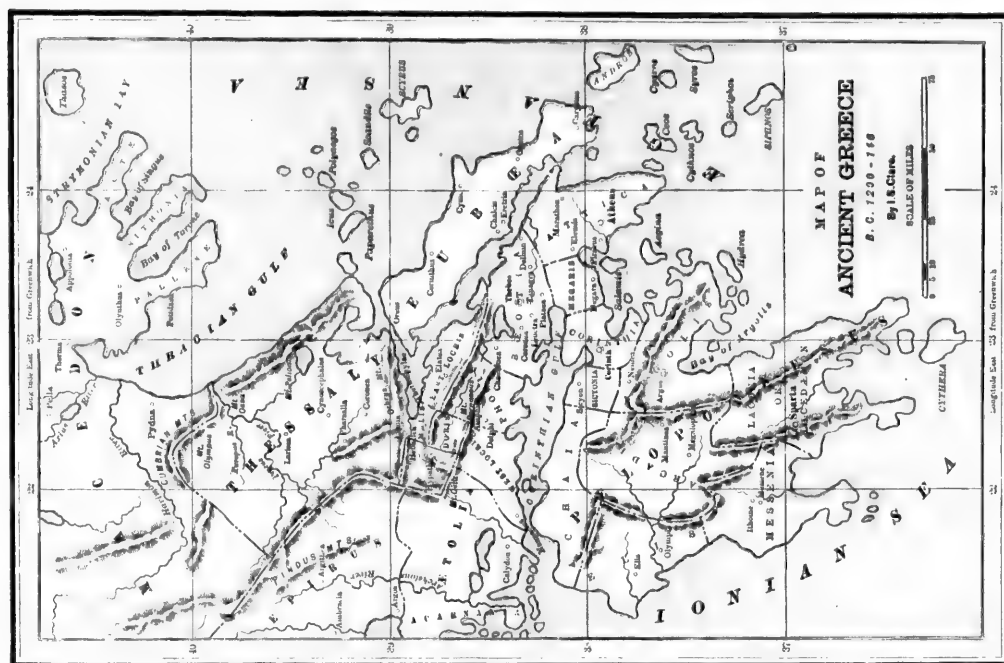
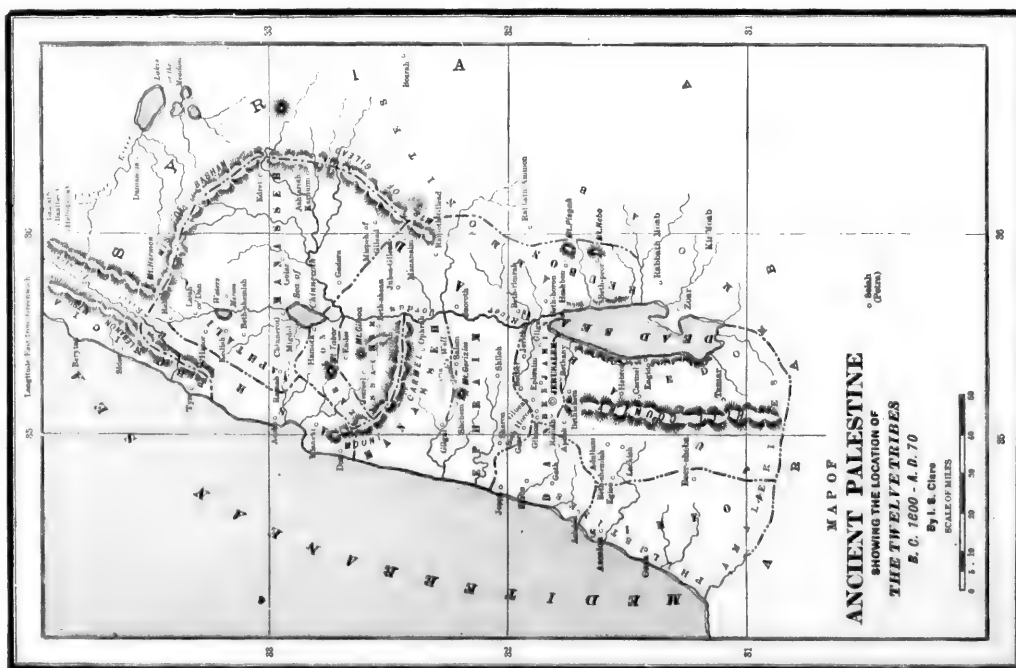


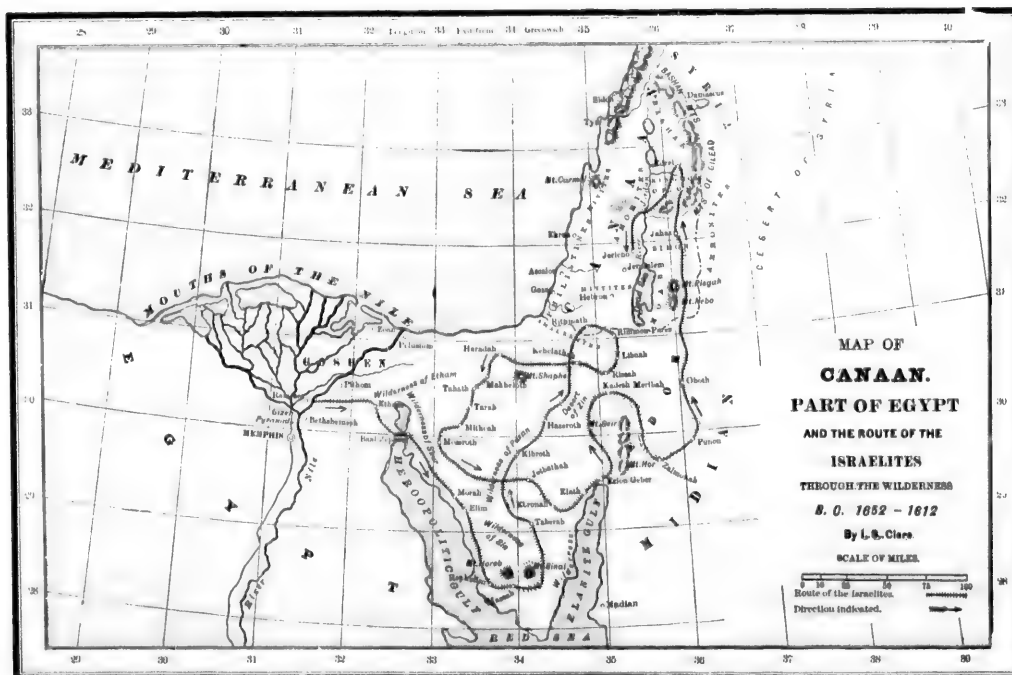
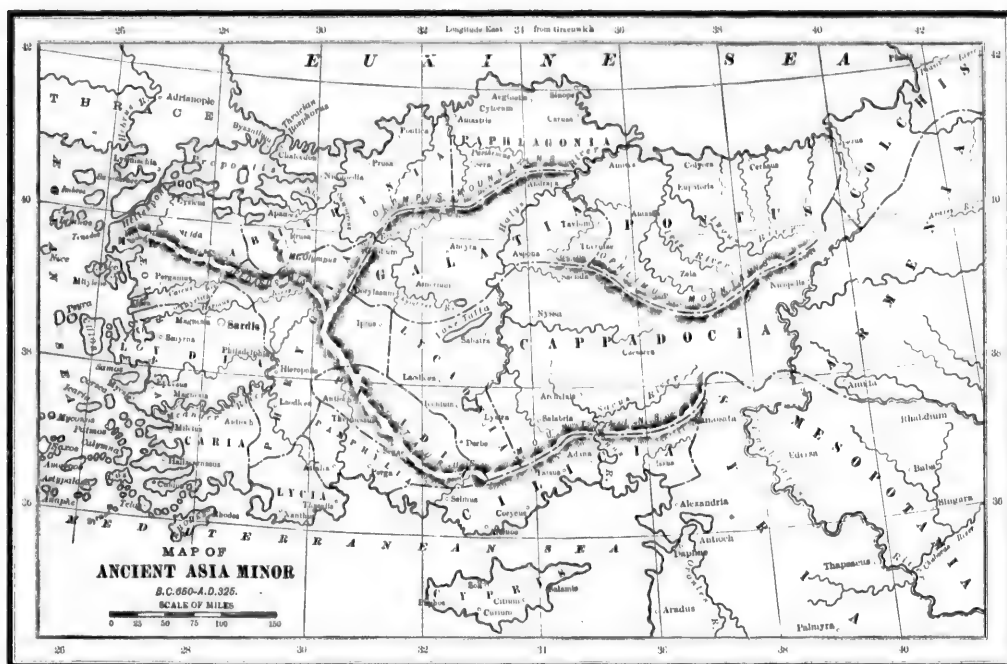












MAP OF THE
EARLIEST HISTORIC REGIONS
AND THE
BIRTHPLACE OF CIVILIZATION

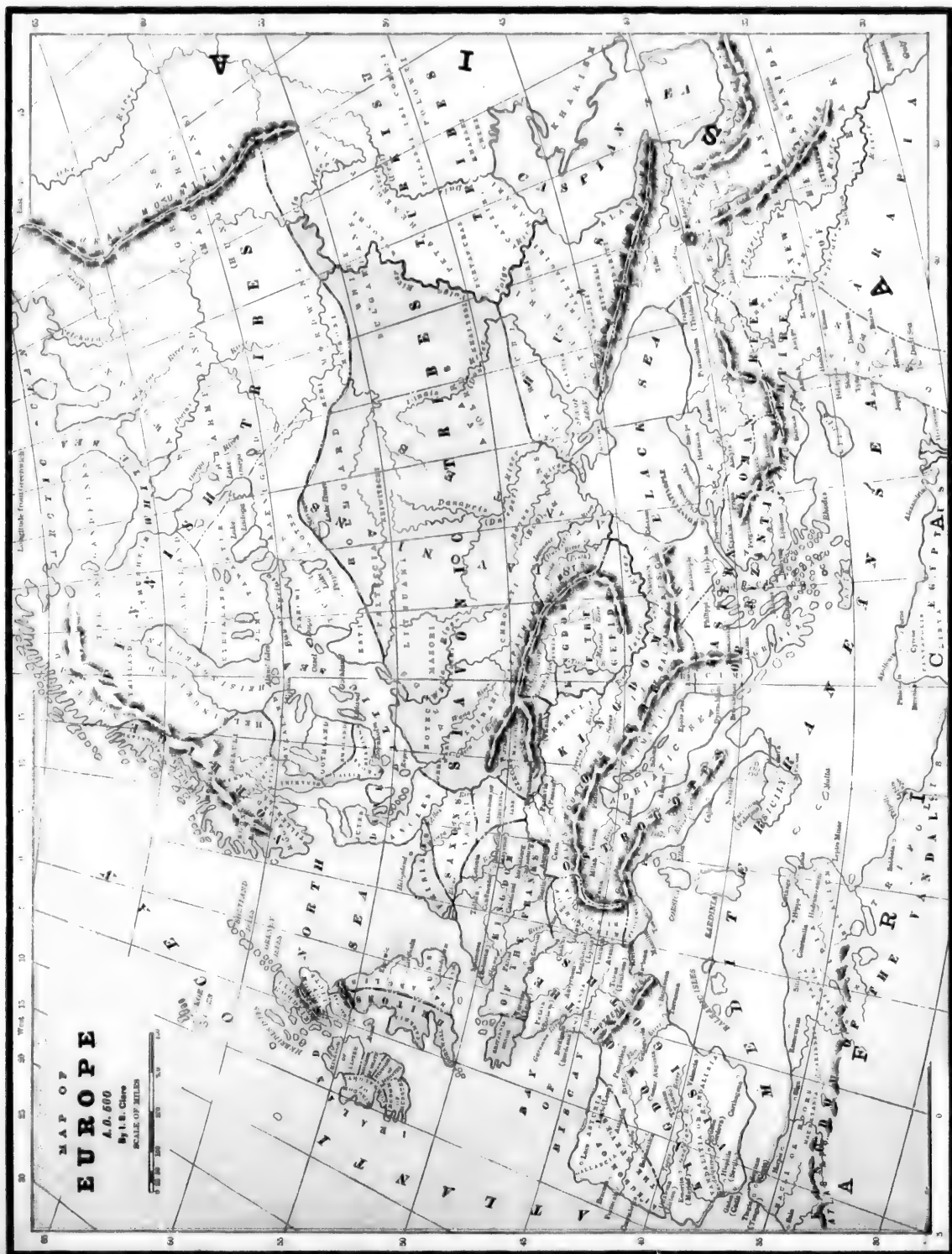
B.C. 3000 1000.

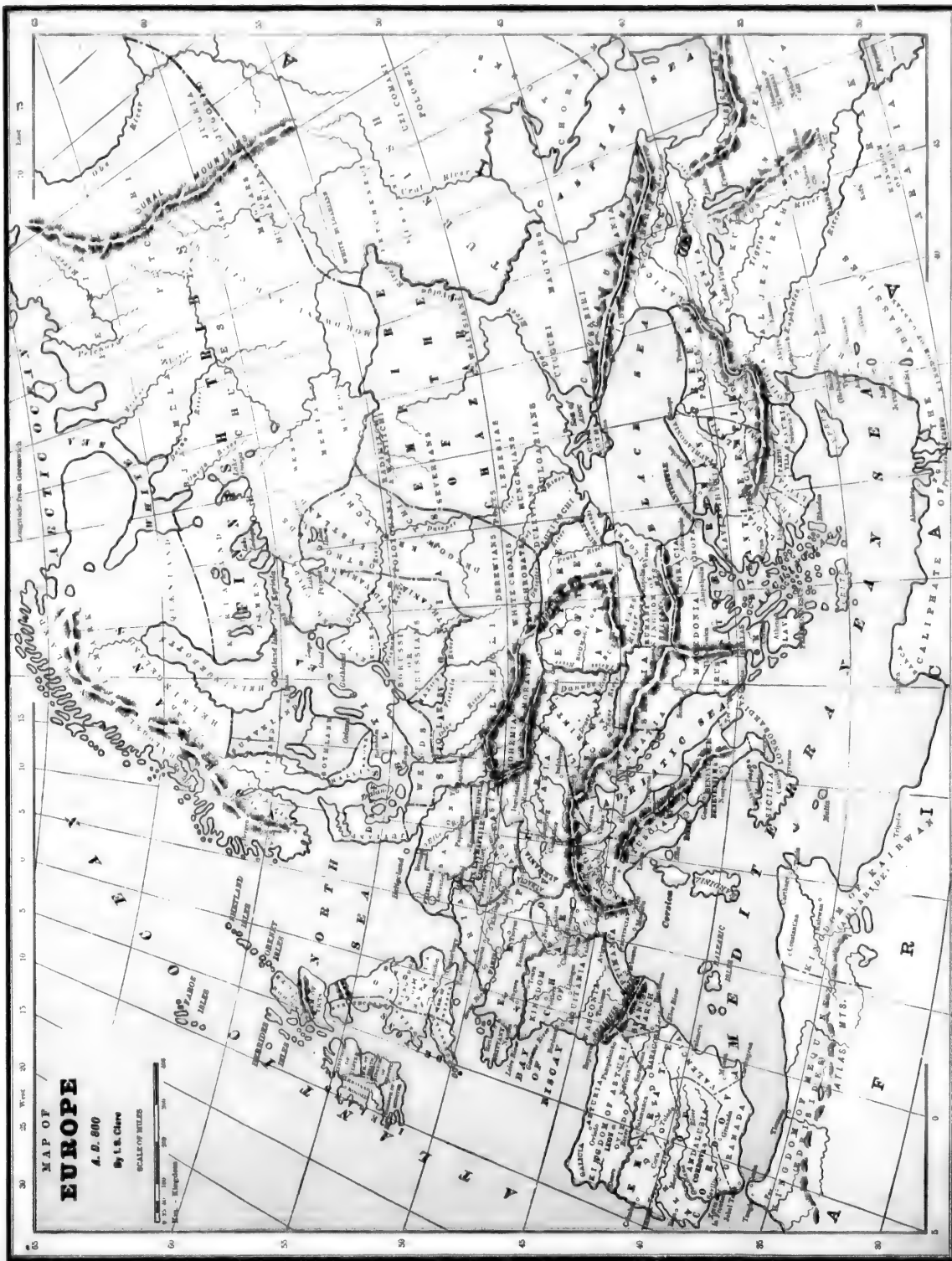
By I. S. Clare

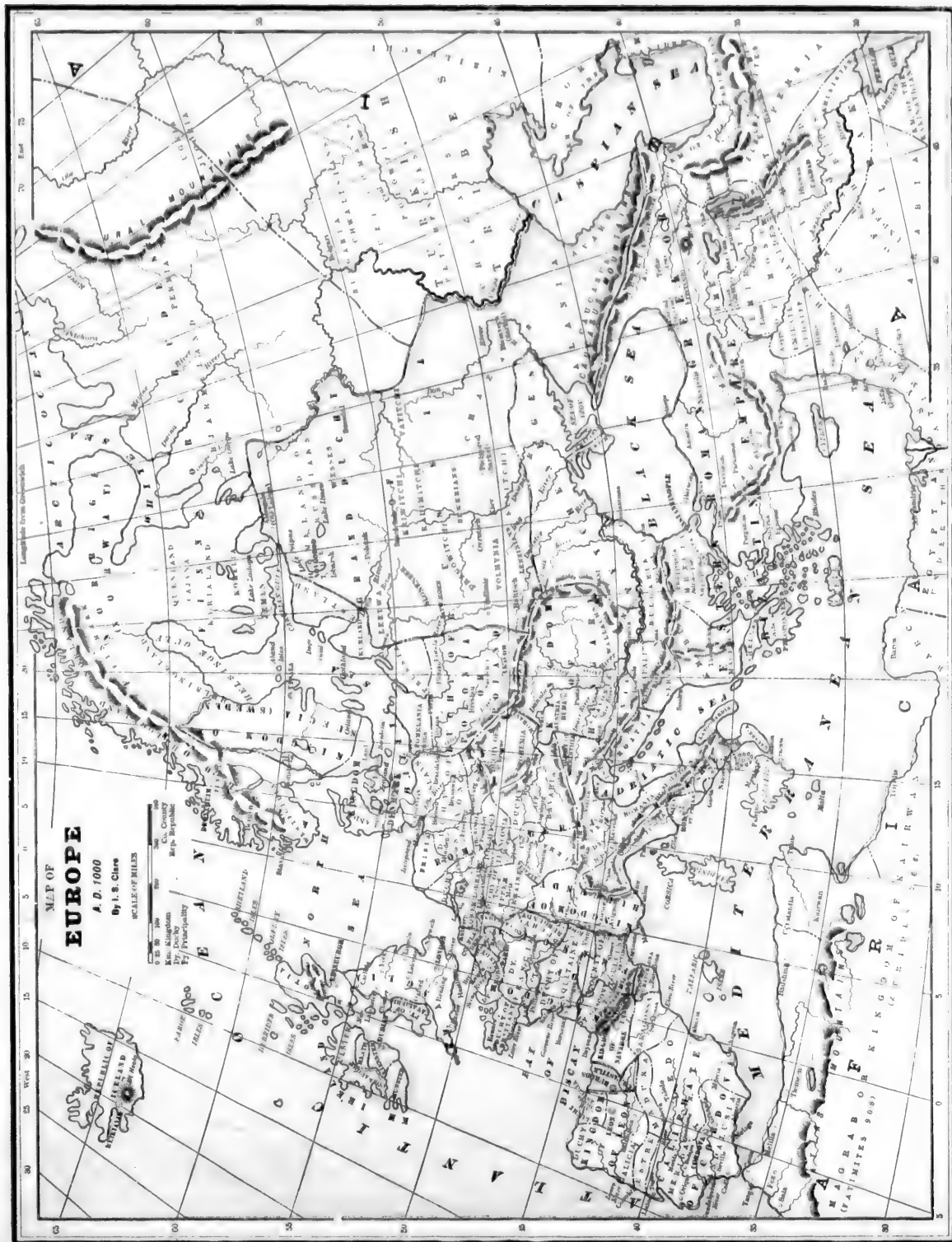
SCALE OF MILES

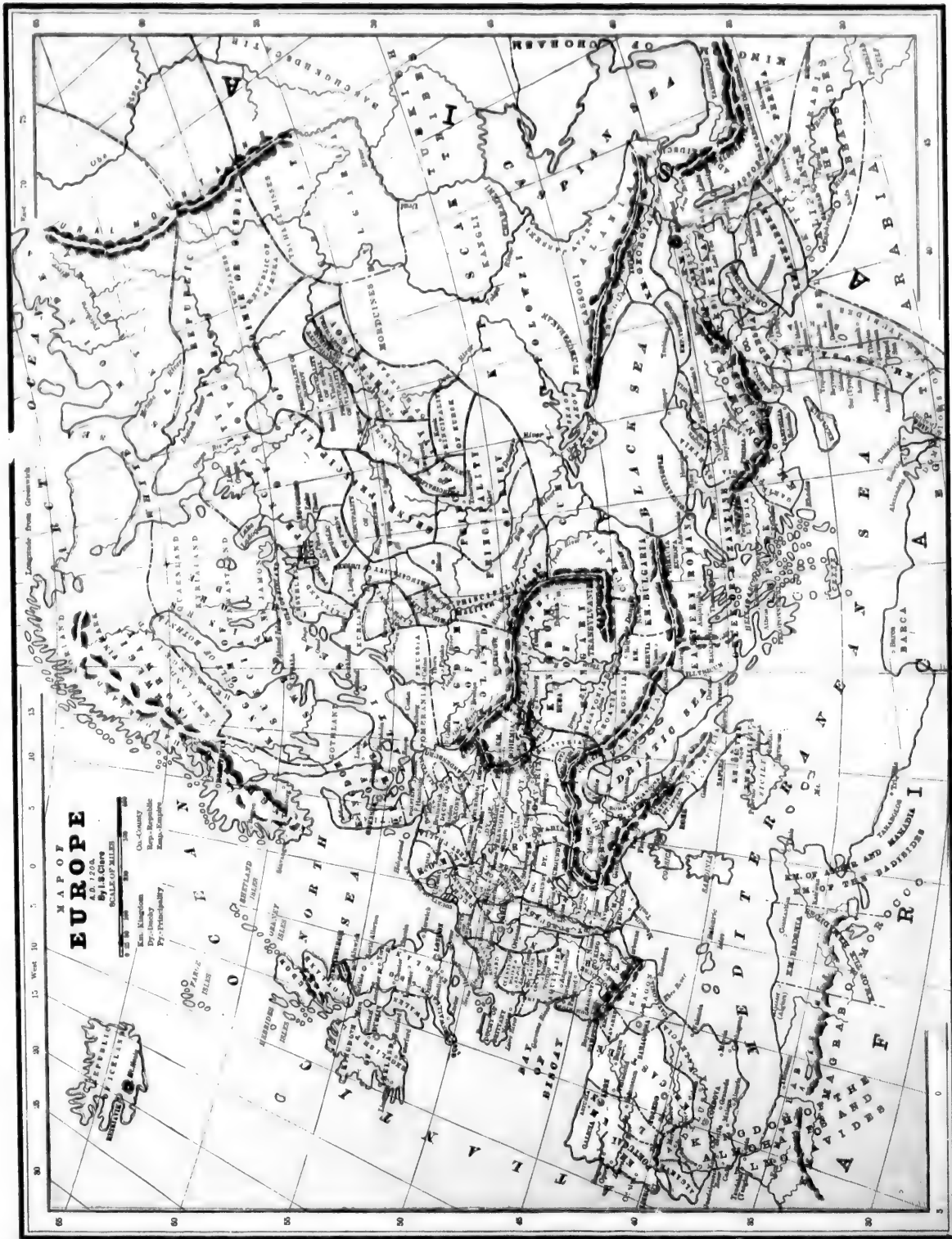
The light part represents the cradle of civilization and history.

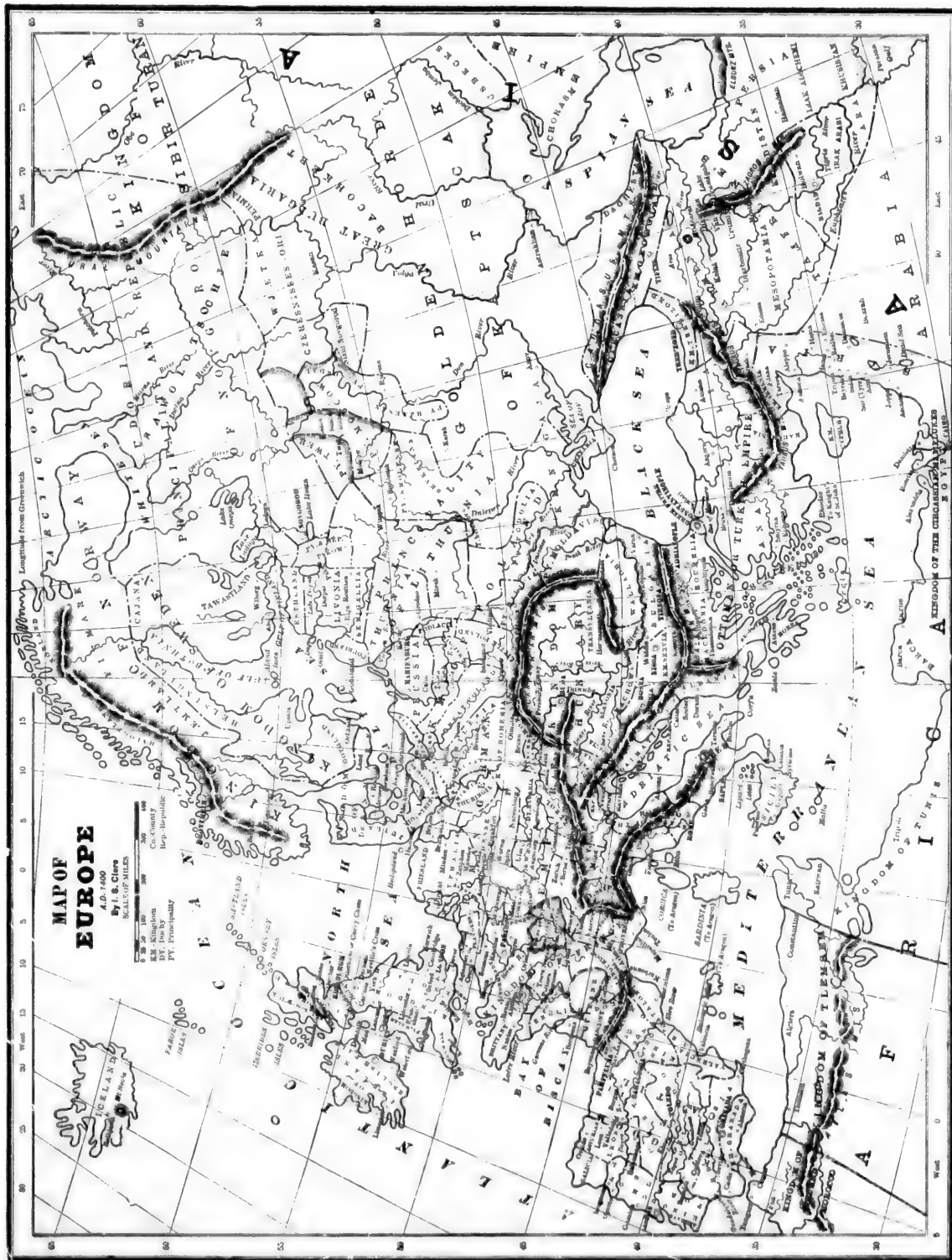




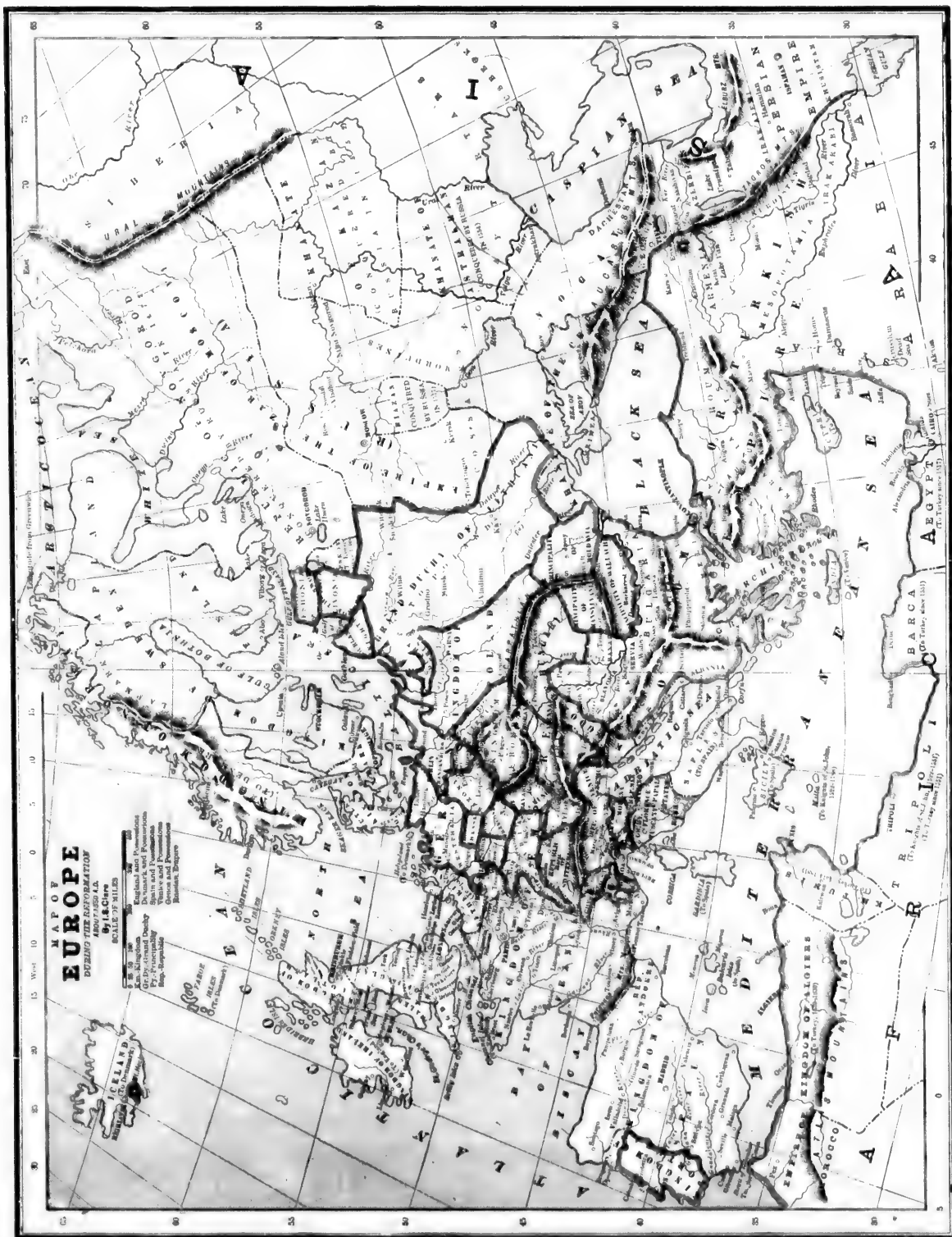


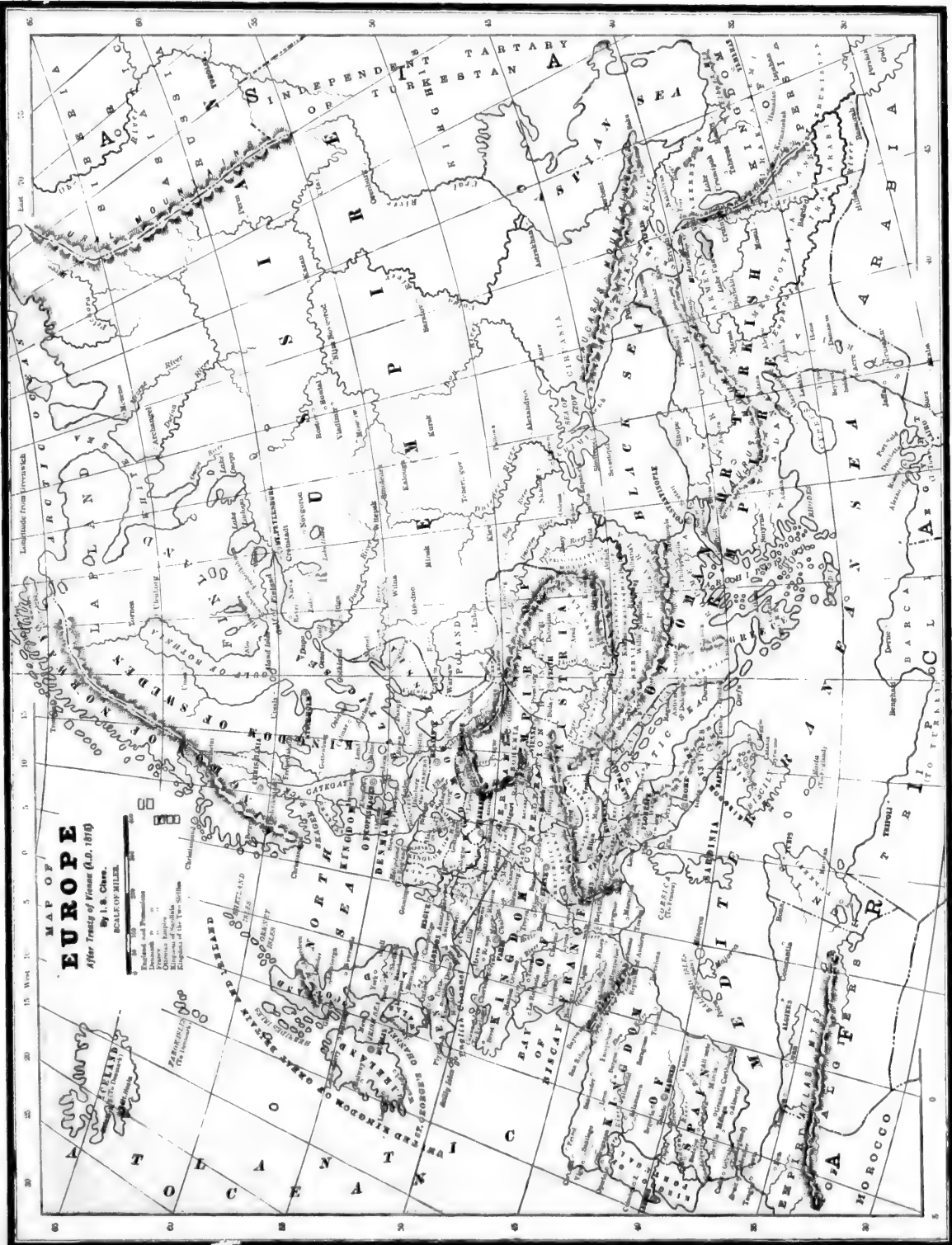


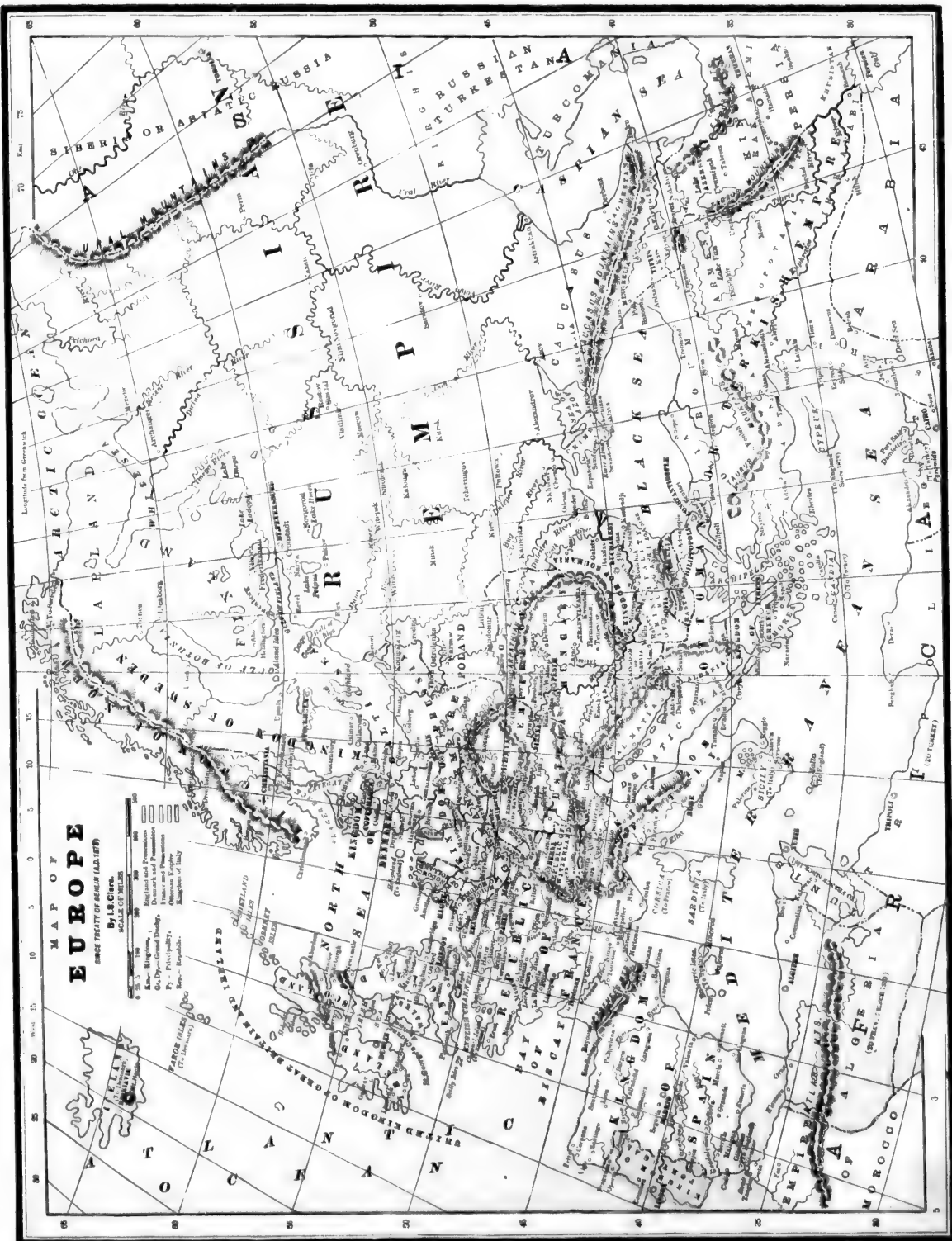










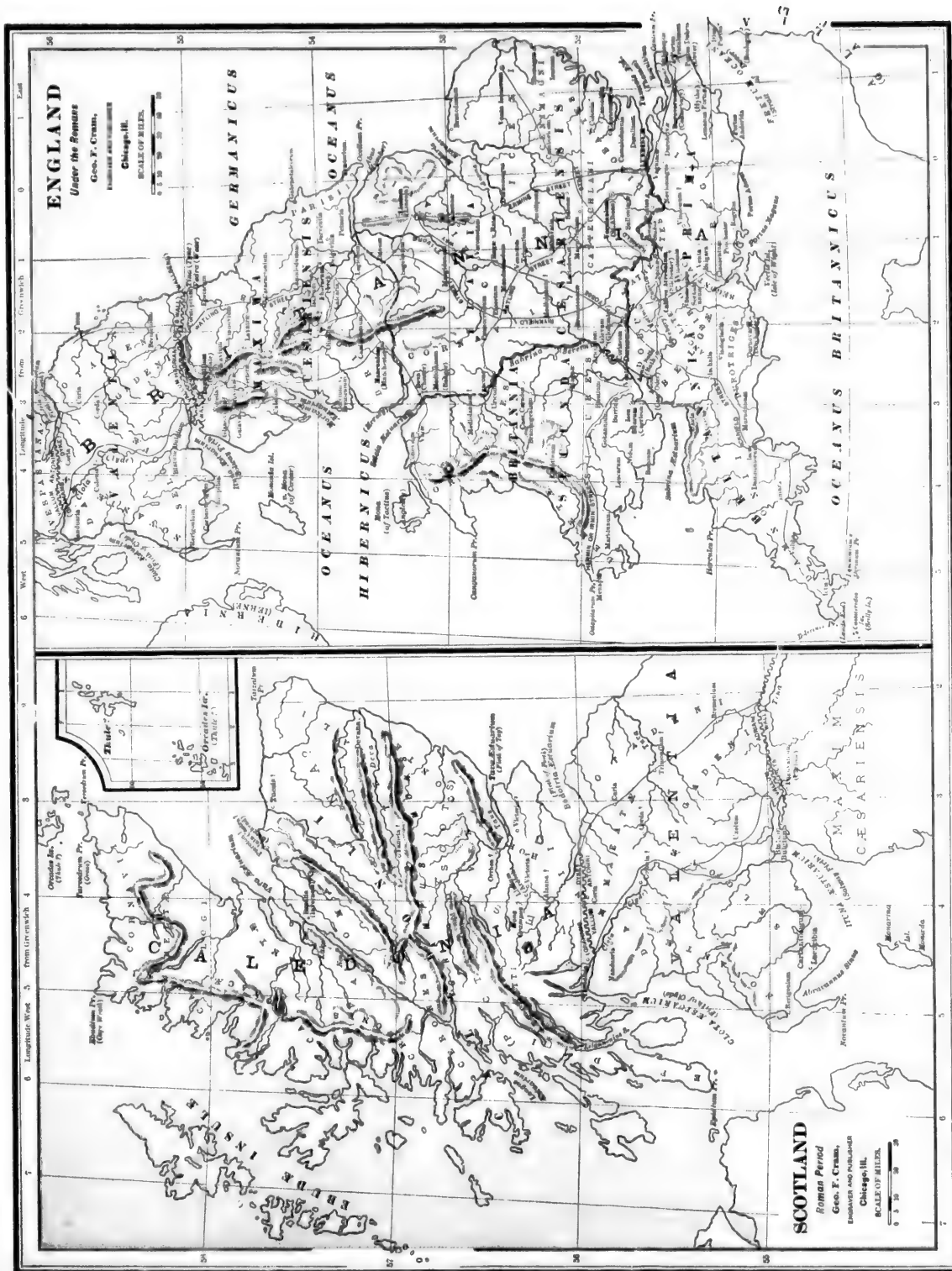


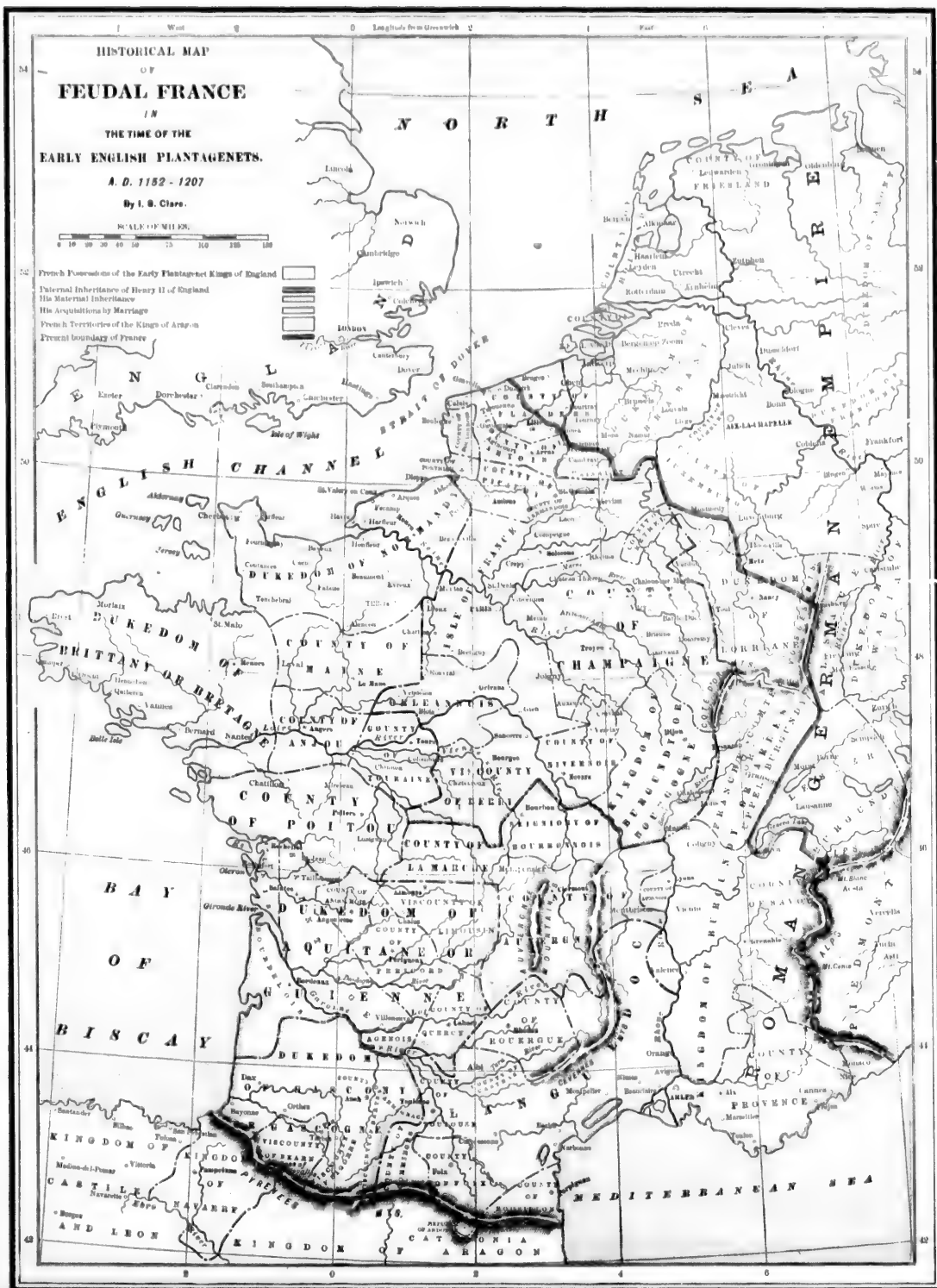
BRITISH ISLANDS

SCALE OF MILES









HISTORICAL MAP OF **FEUDAL FRANCE** DURING THE HUNDRED YEARS' WAR WITH ENGLAND.

A. D. 1338 - 1453

By I. B. Clare

SCALE OF MILES.
0 10 20 30 40 50 60 70 80 90 100

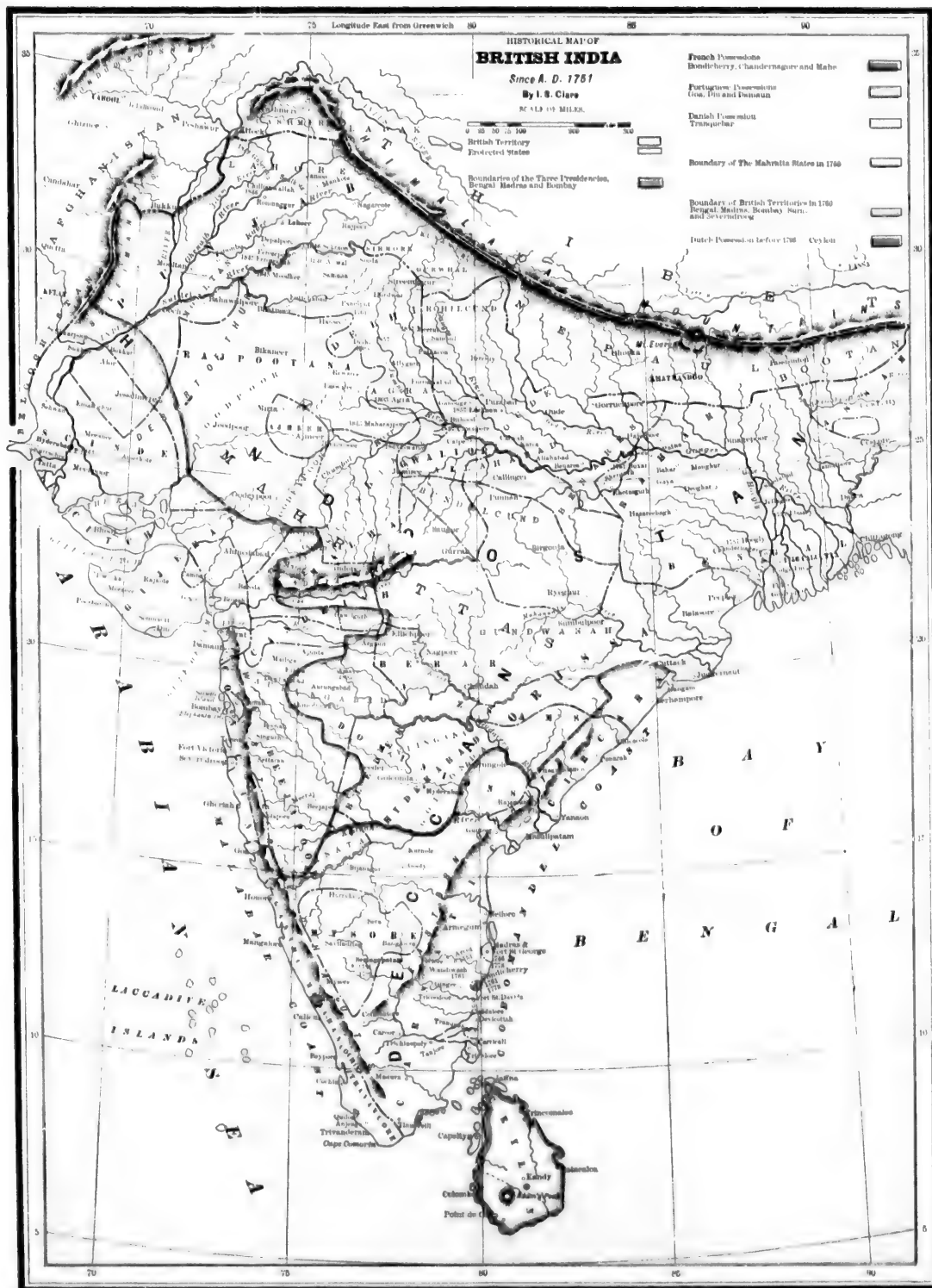
French Possessions of Edward III.
of England (1400-1453)

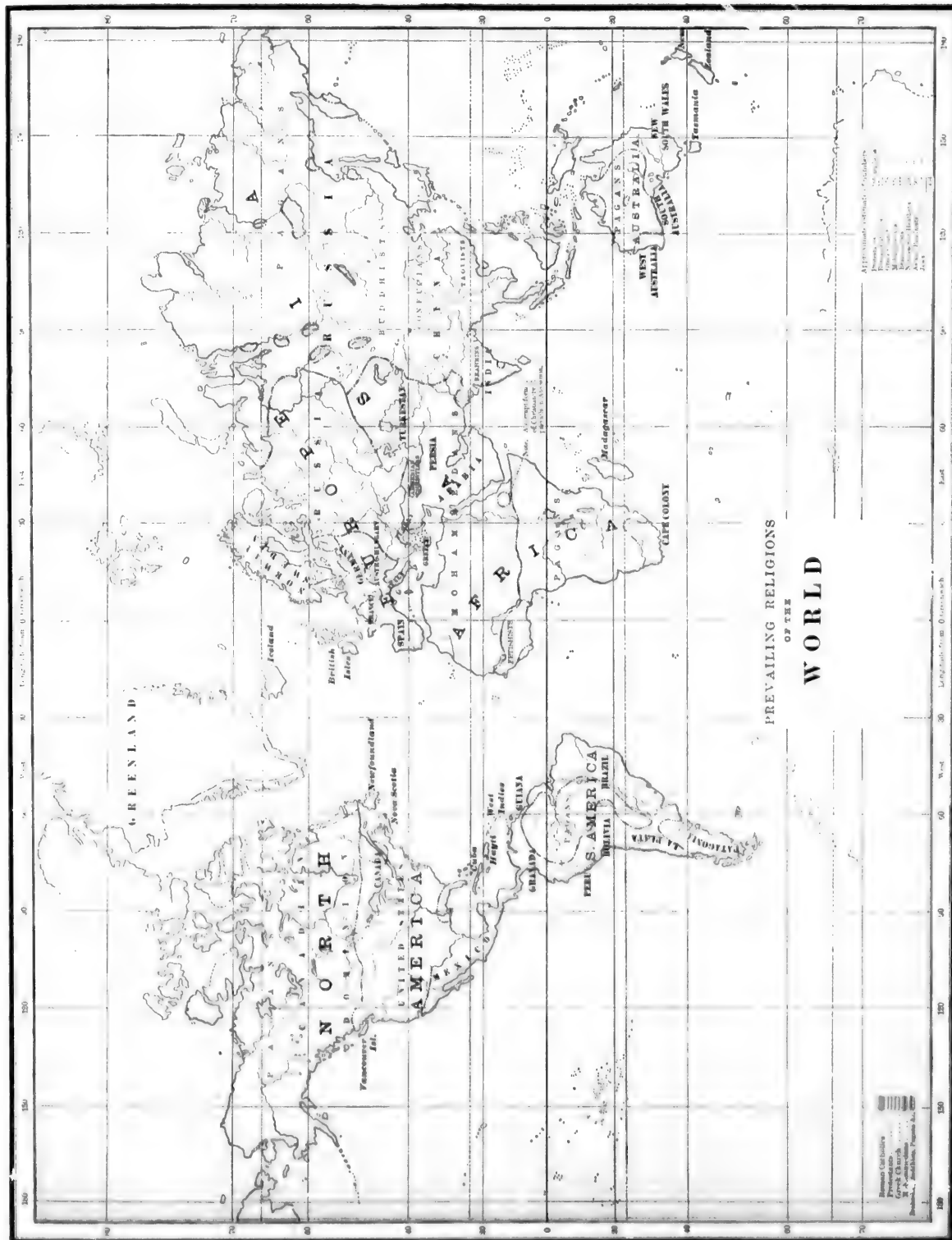
The Pope's French Possessions,
Avignon and Vaucluse.

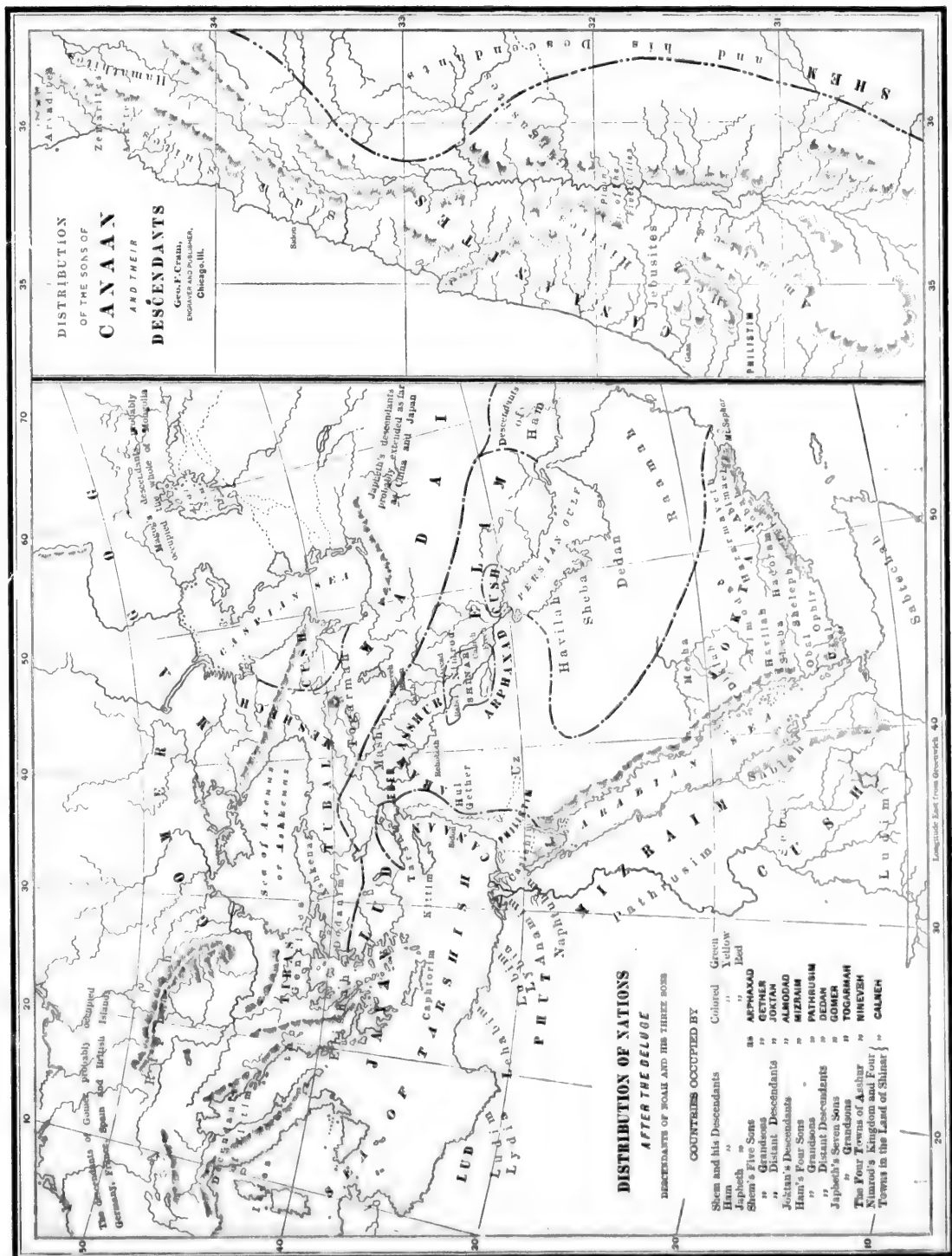
Provinces
of the
Great French
Feudal House

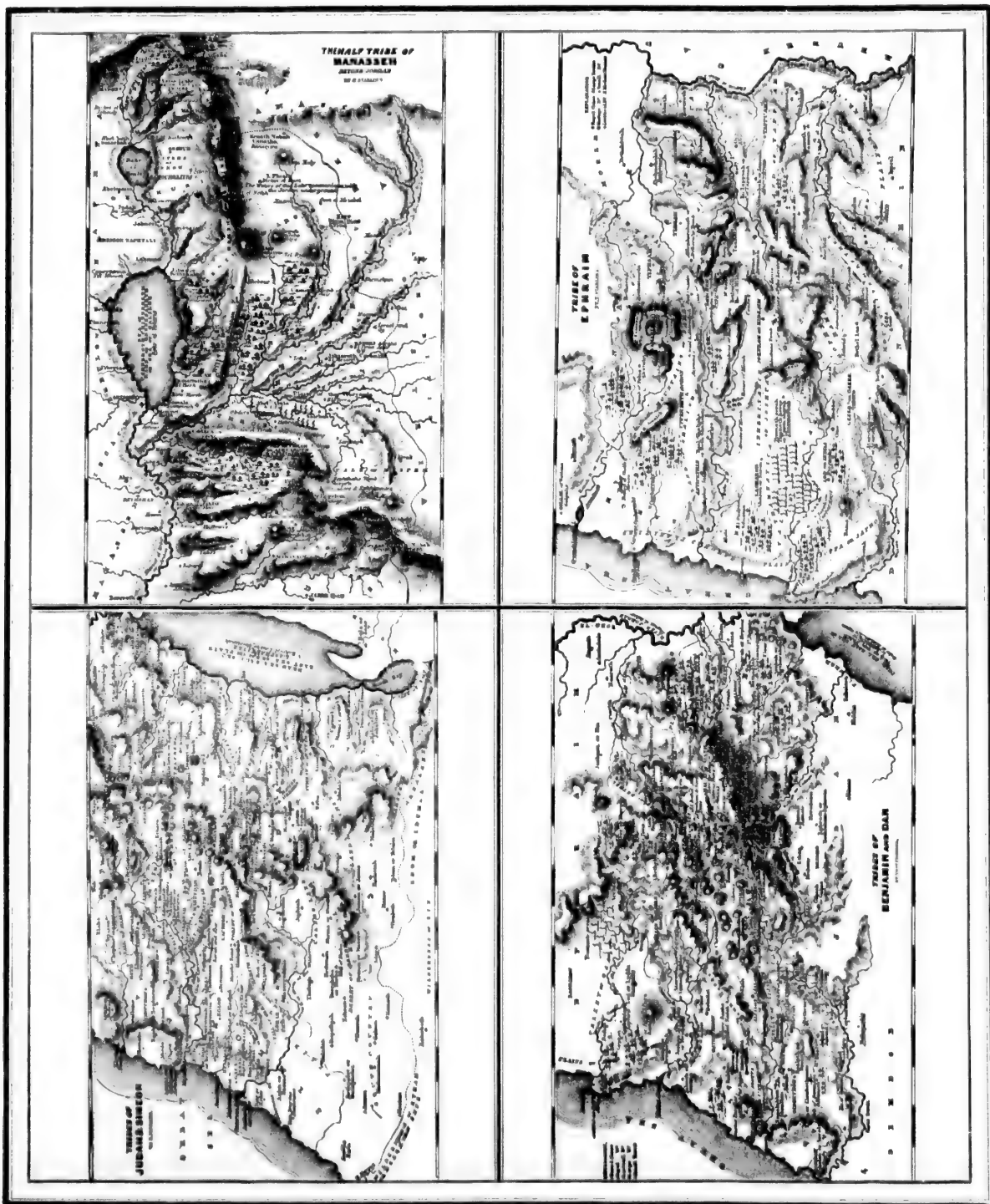
Present boundary of France











TRIBES OF ASHER AND NAFTALI

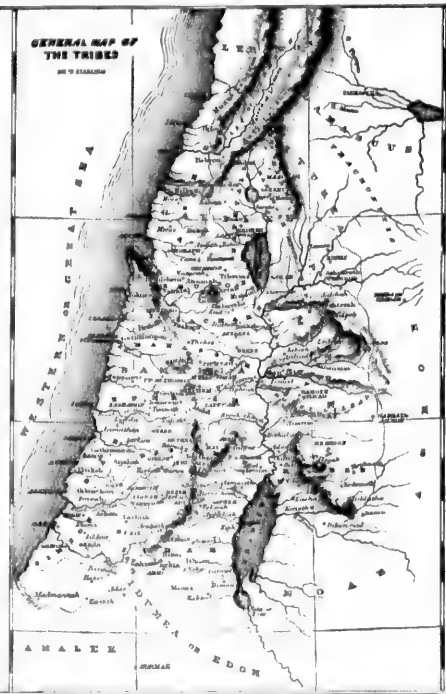
BY THE EDITOR.

EXPLANATION
 1. Asher and Naphtali
 2. Asher and Naphtali
 3. Asher and Naphtali
 4. Asher and Naphtali
 5. Asher and Naphtali
 6. Asher and Naphtali
 7. Asher and Naphtali
 8. Asher and Naphtali
 9. Asher and Naphtali
 10. Asher and Naphtali
 11. Asher and Naphtali
 12. Asher and Naphtali
 13. Asher and Naphtali
 14. Asher and Naphtali
 15. Asher and Naphtali
 16. Asher and Naphtali
 17. Asher and Naphtali
 18. Asher and Naphtali
 19. Asher and Naphtali
 20. Asher and Naphtali
 21. Asher and Naphtali
 22. Asher and Naphtali
 23. Asher and Naphtali
 24. Asher and Naphtali
 25. Asher and Naphtali
 26. Asher and Naphtali
 27. Asher and Naphtali
 28. Asher and Naphtali
 29. Asher and Naphtali
 30. Asher and Naphtali
 31. Asher and Naphtali
 32. Asher and Naphtali
 33. Asher and Naphtali
 34. Asher and Naphtali
 35. Asher and Naphtali
 36. Asher and Naphtali
 37. Asher and Naphtali
 38. Asher and Naphtali
 39. Asher and Naphtali
 40. Asher and Naphtali
 41. Asher and Naphtali
 42. Asher and Naphtali
 43. Asher and Naphtali
 44. Asher and Naphtali
 45. Asher and Naphtali
 46. Asher and Naphtali
 47. Asher and Naphtali
 48. Asher and Naphtali
 49. Asher and Naphtali
 50. Asher and Naphtali
 51. Asher and Naphtali
 52. Asher and Naphtali
 53. Asher and Naphtali
 54. Asher and Naphtali
 55. Asher and Naphtali
 56. Asher and Naphtali
 57. Asher and Naphtali
 58. Asher and Naphtali
 59. Asher and Naphtali
 60. Asher and Naphtali
 61. Asher and Naphtali
 62. Asher and Naphtali
 63. Asher and Naphtali
 64. Asher and Naphtali
 65. Asher and Naphtali
 66. Asher and Naphtali
 67. Asher and Naphtali
 68. Asher and Naphtali
 69. Asher and Naphtali
 70. Asher and Naphtali
 71. Asher and Naphtali
 72. Asher and Naphtali
 73. Asher and Naphtali
 74. Asher and Naphtali
 75. Asher and Naphtali
 76. Asher and Naphtali
 77. Asher and Naphtali
 78. Asher and Naphtali
 79. Asher and Naphtali
 80. Asher and Naphtali
 81. Asher and Naphtali
 82. Asher and Naphtali
 83. Asher and Naphtali
 84. Asher and Naphtali
 85. Asher and Naphtali
 86. Asher and Naphtali
 87. Asher and Naphtali
 88. Asher and Naphtali
 89. Asher and Naphtali
 90. Asher and Naphtali
 91. Asher and Naphtali
 92. Asher and Naphtali
 93. Asher and Naphtali
 94. Asher and Naphtali
 95. Asher and Naphtali
 96. Asher and Naphtali
 97. Asher and Naphtali
 98. Asher and Naphtali
 99. Asher and Naphtali
 100. Asher and Naphtali



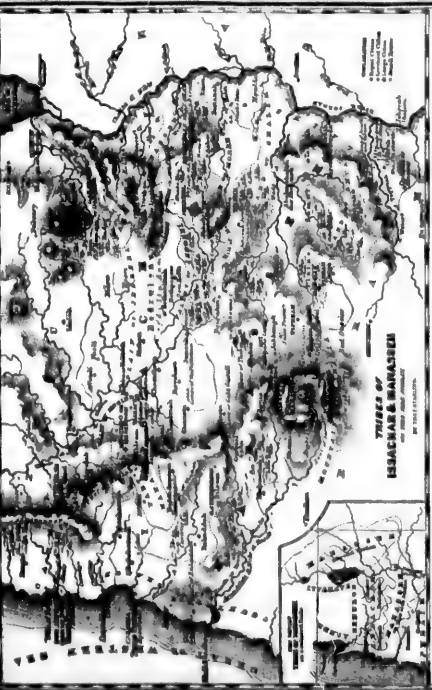
GENERAL MAP OF THE TRIBES

BY THE EDITOR.



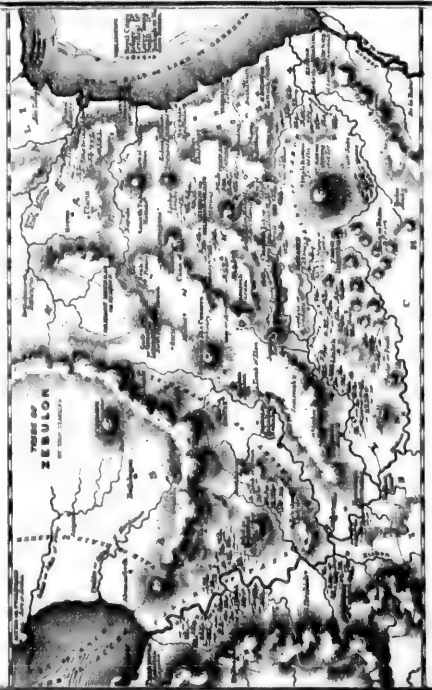
TRIBES OF ISACHAR & MANASSEH

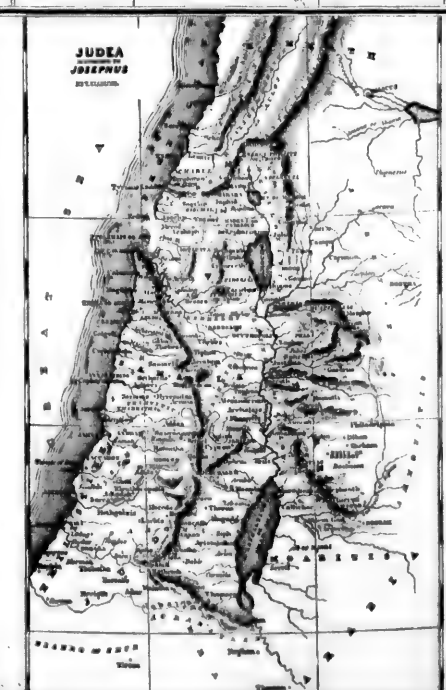
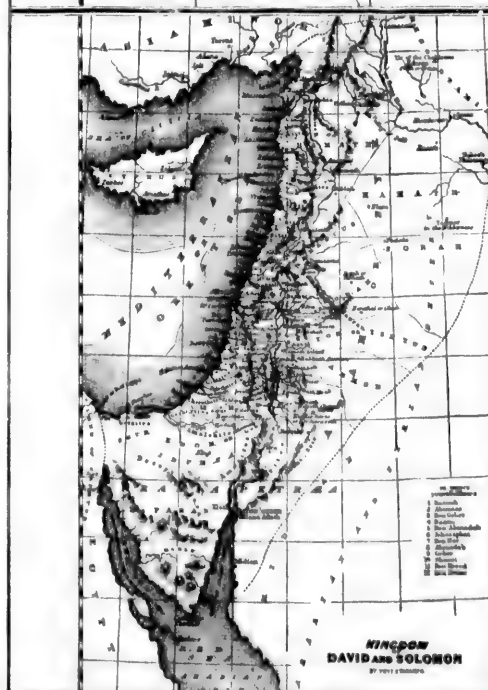
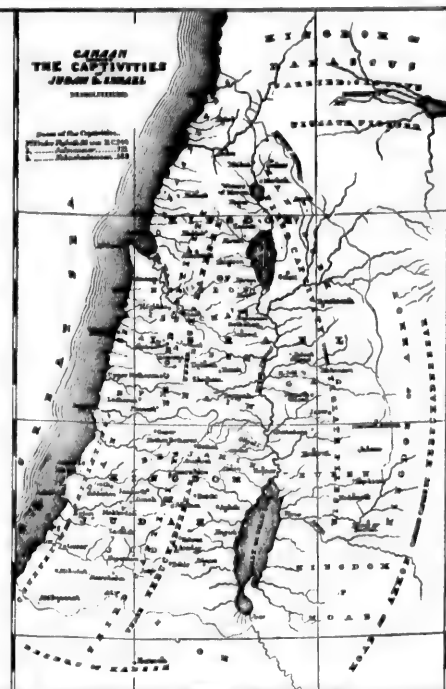
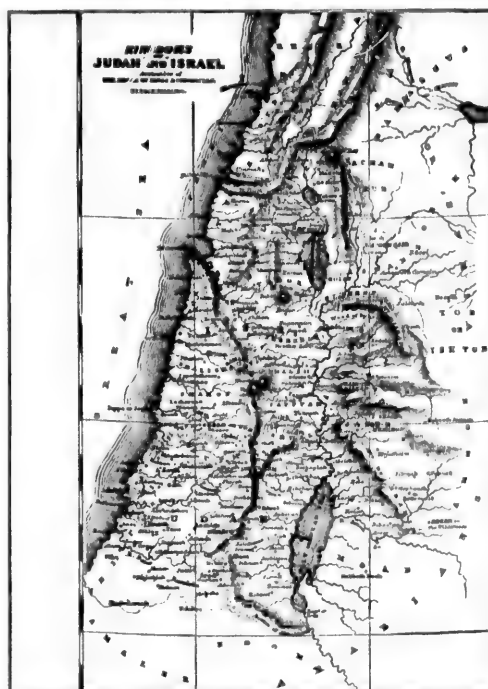
BY THE EDITOR.

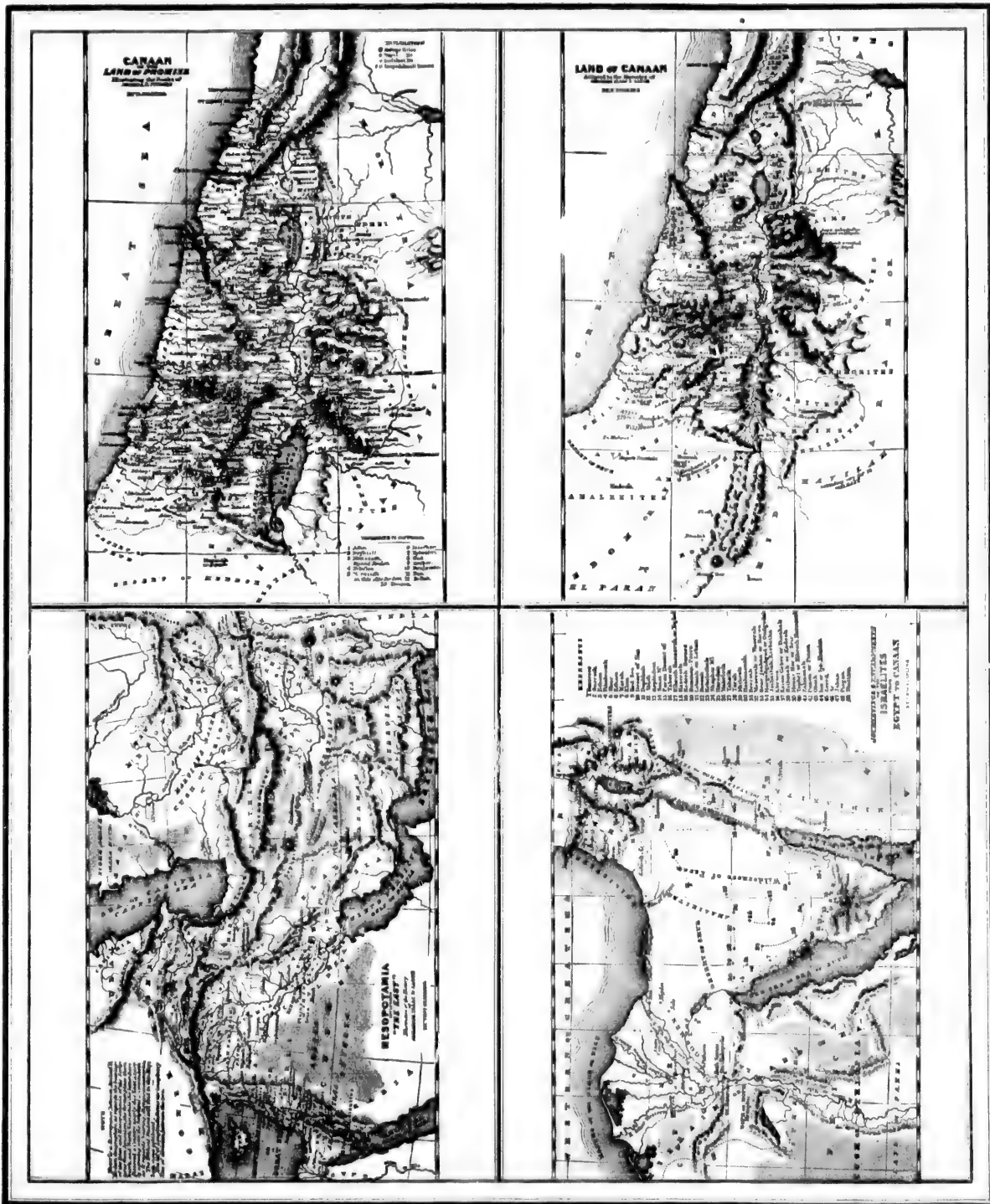


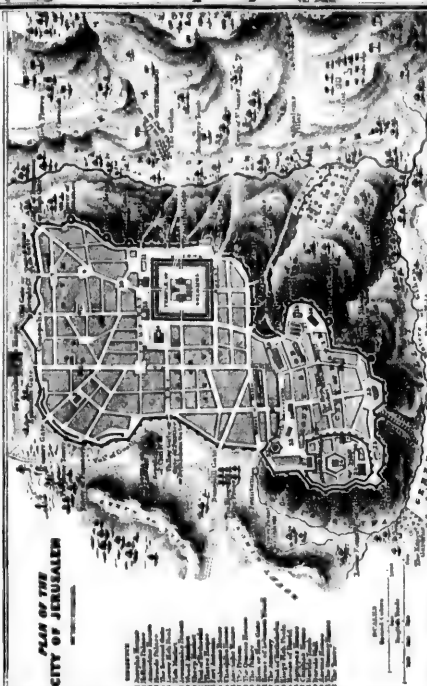
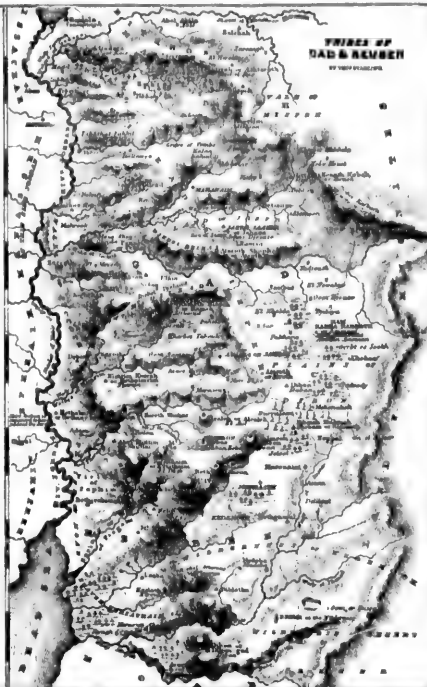
TRIBES OF ZEBULON

BY THE EDITOR.

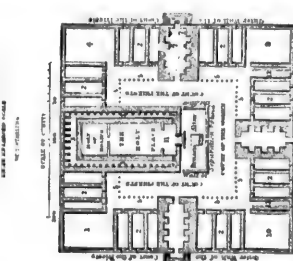






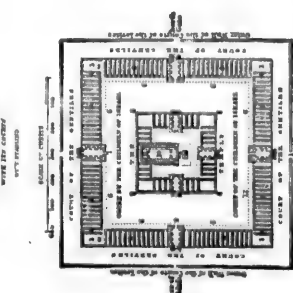


PLAN OF THE TEMPLE



REFERENCE
1. The Temple of Solomon
2. The Temple of Zerubbabel
3. The Temple of Herod
4. The Temple of the Christians
5. The Temple of the Muslims
6. The Temple of the Jews
7. The Temple of the Samaritans
8. The Temple of the Zoroastrians
9. The Temple of the Hindus
10. The Temple of the Buddhists
11. The Temple of the Jains
12. The Temple of the Sikhs
13. The Temple of the Parsees
14. The Temple of the Brahmins
15. The Temple of the Kshatriyas
16. The Temple of the Vaishnavas
17. The Temple of the Shaktas
18. The Temple of the Tantrikas
19. The Temple of the Nathas
20. The Temple of the Siddhas
21. The Temple of the Yogis
22. The Temple of the Bhikkhus
23. The Temple of the Monks
24. The Temple of the Nuns
25. The Temple of the Priests
26. The Temple of the Priests
27. The Temple of the Priests
28. The Temple of the Priests
29. The Temple of the Priests
30. The Temple of the Priests

PLAN OF THE TEMPLE



REFERENCE
1. The Temple of Solomon
2. The Temple of Zerubbabel
3. The Temple of Herod
4. The Temple of the Christians
5. The Temple of the Muslims
6. The Temple of the Jews
7. The Temple of the Samaritans
8. The Temple of the Zoroastrians
9. The Temple of the Hindus
10. The Temple of the Buddhists
11. The Temple of the Jains
12. The Temple of the Sikhs
13. The Temple of the Parsees
14. The Temple of the Brahmins
15. The Temple of the Kshatriyas
16. The Temple of the Vaishnavas
17. The Temple of the Shaktas
18. The Temple of the Tantrikas
19. The Temple of the Nathas
20. The Temple of the Siddhas
21. The Temple of the Yogis
22. The Temple of the Bhikkhus
23. The Temple of the Monks
24. The Temple of the Nuns
25. The Temple of the Priests
26. The Temple of the Priests
27. The Temple of the Priests
28. The Temple of the Priests
29. The Temple of the Priests
30. The Temple of the Priests

LIST OF POST OFFICES IN CANADA.

[illegible]

LIST OF POST OFFICES IN CANADA, 1887

[illegible]

LIST OF POST OFFICES IN CANADA

[illegible]

LIST OF POST OFFICES IN CANADA.

[illegible]

LIST OF POST OFFICES IN CANADA.

[illegible]

LIST OF POST OFFICES IN CANADA

[illegible]

LIST OF POST OFFICES IN CANADA, 1887

[illegible]

LIST OF POST OFFICES IN CANADA.

[illegible]

LIST OF POST OFFICES IN CANADA.

[illegible]

LIST OF POST OFFICES IN CANADA.

[illegible]

LIST OF POST OFFICES IN CANADA

[illegible]

LIST OF POST OFFICES IN CANADA.

[illegible]

LIST OF POST OFFICES IN CANADA.

[illegible]

ALPHABETICAL LIST OF TOWNS AND COUNTIES.

The following is an alphabetical list by states of every county, city, town, village and post-office in the United States, with their population, using the census of 1880 as a basis, except in cases where later reports of a reliable character show a decided gain. Places whose population is not ascertainable are marked thus—x. State capitals are in caps, thus—**BOSTON**. County towns are in full-faced type, thus—**Battle**. Post-offices are in Roman, thus—**Bladale**. Places not post-offices are in italic, thus—*Abby*. Express offices are indicated thus—**e**. The index letters refer to that portion of the state in which the several counties are located, as follows:—

N.....Northern E.....Eastern N. E.....North-Eastern N. W.....North-Western
S.....Southern W.....Western S. E.....South-Eastern S. W.....South-Western
C.....Central.

To find any place, first find the county in which it is situated, using the index letters to ascertain its location. The county name being large is quickly seen, and the town will be readily found within its boundaries if on the map. Many small places have been left off the maps owing to lack of space to engrave them, but they will all be found in this list, and their locations can be readily determined by means of the index letters.

ALABAMA.

ALABAMA.			TOWNS, COUNTIES, INDEX.			POP.	TOWNS, COUNTIES, INDEX.			POP.	TOWNS, COUNTIES, INDEX.			POP.	TOWNS, COUNTIES, INDEX.			POP.	TOWNS, COUNTIES, INDEX.			POP.	
COUNTIES.	INDEX.	POP.	COUNTIES.	INDEX.	POP.	COUNTIES.	INDEX.	POP.	COUNTIES.	INDEX.	POP.	COUNTIES.	INDEX.	POP.	COUNTIES.	INDEX.	POP.	COUNTIES.	INDEX.	POP.	COUNTIES.	INDEX.	POP.
Anteign	Q	12,115	Applegate, Tuscaloosa	W	80	Bloomfield, Madison	W	30	Cedarville, Hale	W	100	Crane Hill, Calhoun	W	50	Dawson, Etowah	W	50	Deaton, Etowah	W	100	Dixie, Etowah	W	100
Barlow	SW	8,446	Aquila, Choctaw	W	100	Birmingham, Madison	W	100	Central Institute, Elmore	W	100	Crawford, Russell	W	100	Deaton, Etowah	W	100	Dixie, Etowah	W	100	Dixie, Etowah	W	100
Bibb	SW	14,618	Arab, Marshall	W	50	Blount Springs, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolivar	SW	8,446	Arbuckle, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolton	SW	19,603	Archer, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolton	SW	19,603	Archer, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolton	SW	19,603	Archer, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolton	SW	19,603	Archer, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolton	SW	19,603	Archer, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolton	SW	19,603	Archer, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolton	SW	19,603	Archer, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolton	SW	19,603	Archer, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolton	SW	19,603	Archer, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolton	SW	19,603	Archer, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolton	SW	19,603	Archer, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolton	SW	19,603	Archer, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolton	SW	19,603	Archer, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolton	SW	19,603	Archer, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolton	SW	19,603	Archer, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolton	SW	19,603	Archer, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolton	SW	19,603	Archer, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolton	SW	19,603	Archer, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolton	SW	19,603	Archer, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolton	SW	19,603	Archer, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolton	SW	19,603	Archer, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolton	SW	19,603	Archer, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolton	SW	19,603	Archer, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolton	SW	19,603	Archer, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolton	SW	19,603	Archer, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolton	SW	19,603	Archer, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolton	SW	19,603	Archer, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolton	SW	19,603	Archer, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolton	SW	19,603	Archer, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolton	SW	19,603	Archer, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolton	SW	19,603	Archer, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolton	SW	19,603	Archer, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolton	SW	19,603	Archer, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolton	SW	19,603	Archer, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolton	SW	19,603	Archer, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolton	SW	19,603	Archer, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolton	SW	19,603	Archer, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolton	SW	19,603	Archer, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolton	SW	19,603	Archer, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolton	SW	19,603	Archer, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolton	SW	19,603	Archer, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolton	SW	19,603	Archer, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolton	SW	19,603	Archer, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolton	SW	19,603	Archer, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolton	SW	19,603	Archer, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolton	SW	19,603	Archer, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolton	SW	19,603	Archer, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolton	SW	19,603	Archer, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolton	SW	19,603	Archer, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolton	SW	19,603	Archer, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100
Bolton	SW	19,603	Archer, Choctaw	W	100	Blossburg, Blount	W	100	Chickasaw, Choctaw	W	100	Greenville, Choctaw	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100	Evergreen, Conecuh	W	100

ALABAMA.

[illegible]

ARKANSAS

TOWNS.	COUNTIES.	INDEX.	POP.	TOWNS.	COUNTIES.	INDEX.	POP.	TOWNS.	COUNTIES.	INDEX.	POP.	TOWNS.	COUNTIES.	INDEX.	POP.	TOWNS.	COUNTIES.	INDEX.	POP.
Farmers, Rock	W	1		Hickory Station, Monty	W	74		Leestown, Jefferson	G	80		Franklin Grove, Wash	N	800		Springfield, Conway	N	800	
Farmington, Washington	W	83		Hickory Valley, Indep	W	75		Leitch, Jefferson	G	81		Franklin, Wash	N	810		Springfield, Conway	N	810	
Farmington, Nevada	W	84		Hicksville, Phillips	W	76		Letcher, Poppe	N	82		Franklinville, Ark	N	820		Springfield, Conway	N	820	
Farmington, Nevada	W	85		Hicksville, Nevada	W	77		Letcher, Poppe	N	83		Franklinville, Ark	N	830		Springfield, Conway	N	830	
Farmington, Nevada	W	86		Hicksville, Nevada	W	78		Letcher, Poppe	N	84		Franklinville, Ark	N	840		Springfield, Conway	N	840	
Farmington, Nevada	W	87		Hicksville, Nevada	W	79		Letcher, Poppe	N	85		Franklinville, Ark	N	850		Springfield, Conway	N	850	
Farmington, Nevada	W	88		Hicksville, Nevada	W	80		Letcher, Poppe	N	86		Franklinville, Ark	N	860		Springfield, Conway	N	860	
Farmington, Nevada	W	89		Hicksville, Nevada	W	81		Letcher, Poppe	N	87		Franklinville, Ark	N	870		Springfield, Conway	N	870	
Farmington, Nevada	W	90		Hicksville, Nevada	W	82		Letcher, Poppe	N	88		Franklinville, Ark	N	880		Springfield, Conway	N	880	
Farmington, Nevada	W	91		Hicksville, Nevada	W	83		Letcher, Poppe	N	89		Franklinville, Ark	N	890		Springfield, Conway	N	890	
Farmington, Nevada	W	92		Hicksville, Nevada	W	84		Letcher, Poppe	N	90		Franklinville, Ark	N	900		Springfield, Conway	N	900	
Farmington, Nevada	W	93		Hicksville, Nevada	W	85		Letcher, Poppe	N	91		Franklinville, Ark	N	910		Springfield, Conway	N	910	
Farmington, Nevada	W	94		Hicksville, Nevada	W	86		Letcher, Poppe	N	92		Franklinville, Ark	N	920		Springfield, Conway	N	920	
Farmington, Nevada	W	95		Hicksville, Nevada	W	87		Letcher, Poppe	N	93		Franklinville, Ark	N	930		Springfield, Conway	N	930	
Farmington, Nevada	W	96		Hicksville, Nevada	W	88		Letcher, Poppe	N	94		Franklinville, Ark	N	940		Springfield, Conway	N	940	
Farmington, Nevada	W	97		Hicksville, Nevada	W	89		Letcher, Poppe	N	95		Franklinville, Ark	N	950		Springfield, Conway	N	950	
Farmington, Nevada	W	98		Hicksville, Nevada	W	90		Letcher, Poppe	N	96		Franklinville, Ark	N	960		Springfield, Conway	N	960	
Farmington, Nevada	W	99		Hicksville, Nevada	W	91		Letcher, Poppe	N	97		Franklinville, Ark	N	970		Springfield, Conway	N	970	
Farmington, Nevada	W	100		Hicksville, Nevada	W	92		Letcher, Poppe	N	98		Franklinville, Ark	N	980		Springfield, Conway	N	980	
Farmington, Nevada	W	101		Hicksville, Nevada	W	93		Letcher, Poppe	N	99		Franklinville, Ark	N	990		Springfield, Conway	N	990	
Farmington, Nevada	W	102		Hicksville, Nevada	W	94		Letcher, Poppe	N	100		Franklinville, Ark	N	1000		Springfield, Conway	N	1000	

[illegible]

CALIFORNIA—COLORADO.[illegible]

[illegible]

INDEX

[illegible]

3

3

FLORIDA.—GEORGIA.

[illegible]

[illegible]

GEORGIA.—IDAHO.—ILLINOIS.

[illegible]

INDIAL. POP	TOWNS	COUNTY
100	100	100
200	200	200
300	300	300
400	400	400
500	500	500
600	600	600
700	700	700
800	800	800
900	900	900
1000	1000	1000
1100	1100	1100
1200	1200	1200
1300	1300	1300
1400	1400	1400
1500	1500	1500
1600	1600	1600
1700	1700	1700
1800	1800	1800
1900	1900	1900
2000	2000	2000
2100	2100	2100
2200	2200	2200
2300	2300	2300
2400	2400	2400
2500	2500	2500
2600	2600	2600
2700	2700	2700
2800	2800	2800
2900	2900	2900
3000	3000	3000
3100	3100	3100
3200	3200	3200
3300	3300	3300
3400	3400	3400
3500	3500	3500
3600	3600	3600
3700	3700	3700
3800	3800	3800
3900	3900	3900
4000	4000	4000
4100	4100	4100
4200	4200	4200
4300	4300	4300
4400	4400	4400
4500	4500	4500
4600	4600	4600
4700	4700	4700
4800	4800	4800
4900	4900	4900
5000	5000	5000
5100	5100	5100
5200	5200	5200
5300	5300	5300
5400	5400	5400
5500	5500	5500
5600	5600	5600
5700	5700	5700
5800	5800	5800
5900	5900	5900
6000	6000	6000
6100	6100	6100
6200	6200	6200
6300	6300	6300
6400	6400	6400
6500	6500	6500
6600	6600	6600
6700	6700	6700
6800	6800	6800
6900	6900	6900
7000	7000	7000
7100	7100	7100
7200	7200	7200
7300	7300	7300
7400	7400	7400
7500	7500	7500
7600	7600	7600
7700	7700	7700
7800	7800	7800
7900	7900	7900
8000	8000	8000
8100	8100	8100
8200	8200	8200
8300	8300	8300
8400	8400	8400
8500	8500	8500
8600	8600	8600
8700	8700	8700
8800	8800	8800
8900	8900	8900
9000	9000	9000
9100	9100	9100
9200	9200	9200
9300	9300	9300
9400	9400	9400
9500	9500	9500
9600	9600	9600
9700	9700	9700
9800	9800	9800
9900	9900	9900
10000	10000	10000

357

ILLINOIS

35

350

INDIANA

[illegible]

.....

IOWA[illegible]

IOWA.

[illegible]

IOWA.—KANSAS

[illegible]

KANSAS.—KENTUCKY.

[illegible]

KENTUCKY.

[illegible]

KENTUCKY.—LOUISIANA.[illegible]

[illegible]

MAINE.—MARYLAND.

[illegible]

•

372

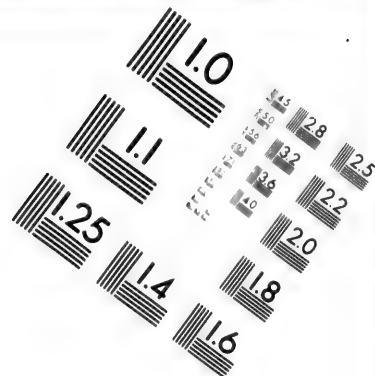
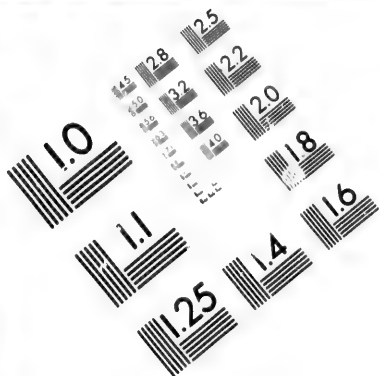
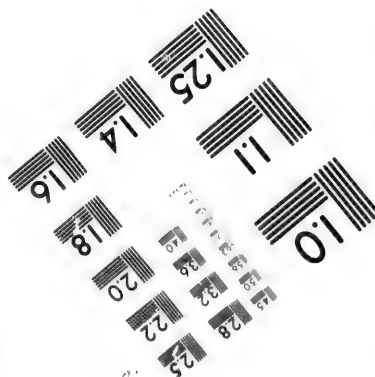
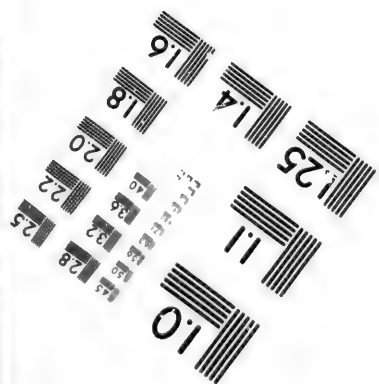
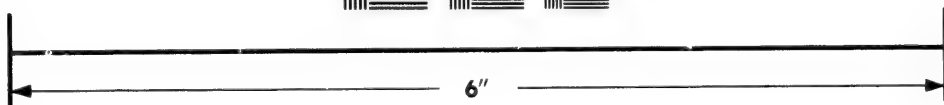
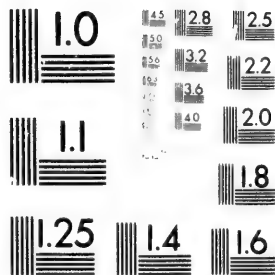


IMAGE EVALUATION TEST TARGET (MT-3)



**Photographic
Sciences
Corporation**

23 WEST MAIN STREET
WEBSTER, N.Y. 14580
(716) 872-4503

4.5
3.6
2.8
2.5
2.2
2.0
1.8

10
5

MICELIGAT

[illegible]

[illegible]

376

MISSISSIPPI[illegible]

	TOWNS.	COUNTIES.	INDEX.	POP.	TOWNS.	COUNTIES.	INDEX.	POP.	TOWNS.
30	Advance, Stoddard.....	SE		75	● Redford, Livingston.....	N		300	Brown

378

[illegible]

MISSOURI.—MONTANA

[illegible]

POP. **NEBRASKA.** TOWNS. COUNTIES. INDEX. POP. T

17128. 19118X.

381

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	52
--	---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----

[illegible]

[illegible]

NEW JERSEY.—NEW MEXICO.—NEW YORK

[illegible]

3

NEW YORK

[illegible]

1

288

389

NORTH CAROLINA.

[illegible]

NORTH CAROLINA

OHIO.

OHIC

[illegible]

[illegible]

OHIO[illegible]

PENNSYLVANIA

[illegible]

PENNSYLVANIA

[illegible]

39

PENNSYLVANIA

POP. TOWNS, COUNTIES, INDELS.		POP. TOWNS, COUNTIES, INDELS.		POP. TOWNS, COUNTIES, INDELS.		POP. TOWNS, COUNTIES, INDELS.	
80	Bowen, Washington, SW	80	Reut Center, Westmoreland, NE	80	Smith's Ferry, Beaver, W	80	Tracy, Erie, N
81	Bowling, Perry, W	81	Reynolds, Westmoreland, W	81	Smith's Hill, Crawford, C	81	Tracy, Erie, N
82	Bowling, Perry, W	82	Reynolds, Westmoreland, W	82	Smith's Hill, Crawford, C	82	Tracy, Erie, N
83	Bowling, Perry, W	83	Reynolds, Westmoreland, W	83	Smith's Hill, Crawford, C	83	Tracy, Erie, N
84	Bowling, Perry, W	84	Reynolds, Westmoreland, W	84	Smith's Hill, Crawford, C	84	Tracy, Erie, N
85	Bowling, Perry, W	85	Reynolds, Westmoreland, W	85	Smith's Hill, Crawford, C	85	Tracy, Erie, N
86	Bowling, Perry, W	86	Reynolds, Westmoreland, W	86	Smith's Hill, Crawford, C	86	Tracy, Erie, N
87	Bowling, Perry, W	87	Reynolds, Westmoreland, W	87	Smith's Hill, Crawford, C	87	Tracy, Erie, N
88	Bowling, Perry, W	88	Reynolds, Westmoreland, W	88	Smith's Hill, Crawford, C	88	Tracy, Erie, N
89	Bowling, Perry, W	89	Reynolds, Westmoreland, W	89	Smith's Hill, Crawford, C	89	Tracy, Erie, N
90	Bowling, Perry, W	90	Reynolds, Westmoreland, W	90	Smith's Hill, Crawford, C	90	Tracy, Erie, N
91	Bowling, Perry, W	91	Reynolds, Westmoreland, W	91	Smith's Hill, Crawford, C	91	Tracy, Erie, N
92	Bowling, Perry, W	92	Reynolds, Westmoreland, W	92	Smith's Hill, Crawford, C	92	Tracy, Erie, N
93	Bowling, Perry, W	93	Reynolds, Westmoreland, W	93	Smith's Hill, Crawford, C	93	Tracy, Erie, N
94	Bowling, Perry, W	94	Reynolds, Westmoreland, W	94	Smith's Hill, Crawford, C	94	Tracy, Erie, N
95	Bowling, Perry, W	95	Reynolds, Westmoreland, W	95	Smith's Hill, Crawford, C	95	Tracy, Erie, N
96	Bowling, Perry, W	96	Reynolds, Westmoreland, W	96	Smith's Hill, Crawford, C	96	Tracy, Erie, N
97	Bowling, Perry, W	97	Reynolds, Westmoreland, W	97	Smith's Hill, Crawford, C	97	Tracy, Erie, N
98	Bowling, Perry, W	98	Reynolds, Westmoreland, W	98	Smith's Hill, Crawford, C	98	Tracy, Erie, N
99	Bowling, Perry, W	99	Reynolds, Westmoreland, W	99	Smith's Hill, Crawford, C	99	Tracy, Erie, N
100	Bowling, Perry, W	100	Reynolds, Westmoreland, W	100	Smith's Hill, Crawford, C	100	Tracy, Erie, N

[illegible]

Downloaded by [University of California, San Diego] on 04/01/16. Copyright notice: See Terms and Conditions (http://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

40

TENNESSEE

TOWNS, COUNTIES, INDEX, POP.	TOWNS, COUNTIES, INDEX, POP.	TOWNS, COUNTIES, INDEX, POP.	TOWNS, COUNTIES, INDEX, POP.	TOWNS, COUNTIES, INDEX, POP.
187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555 556 557 558 559 560 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575 576 577 578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595 596 597 598 599 600 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617 618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635 636 637 638 639 640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655 656 657 658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675 676 677 678 679 680 681 682 683 684 685 686 687 688 689 690 691 692 693 694 695 696 697 698 699 700 701 702 703 704 705 706 707 708 709 710 711 712 713 714 715 716 717 718 719 720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735 736 737 738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755 756 757 758 759 760 761 762 763 764 765 766 767 768 769 770 771 772 773 774 775 776 777 778 779 780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795 796 797 798 799 800 801 802 803 804 805 806 807 808 809 810 811 812 813 814 815 816 817 818 819 820 821 822 823 824 825 826 827 828 829 830 831 832 833 834 835 836 837 838 839 840 841 842 843 844 845 846 847 848 849 850 851 852 853 854 855 856 857 858 859 860 861 862 863 864 865 866 867 868 869 870 871 872 873 874 875 876 877 878 879 880 881 882 883 884 885 886 887 888 889 890 891 892 893 894 895 896 897 898 899 900 901 902 903 904 905 906 907 908 909 910 911 912 913 914 915 916 917 918 919 920 921 922 923 924 925 926 927 928 929 930 931 932 933 934 935 936 937 938 939 940 941 942 943 944 945 946 947 948 949 950 951 952 953 954 955 956 957 958 959 960 961 962 963 964 965 966 967 968 969 970 971 972 973 974 975 976 977 978 979 980 981 982 983 984 985 986 987 988 989 990 991 992 993 994 995 996 997 998 999 1000	Calo, Crockett, N.E. Cairo, Buncombe, N.E. Calf Killer, Putnam, N.W. Calf, Maury, N.W. Calf, Stewart, N.W. Caldwell, Maury, N.W. Caldwell, Lincoln, N.E. Caldwell, Benton, N.E. Caldwell, Hawkins, N.E. Caldwell, Knox, N.E. Caldwell, Maury, N.W. Camp Creek, Maury, N.W. Camp Creek, White, N.W. Camp Creek, Green, N.W. Camp Ground, Watauga, N.W. Camp Ground, Fayette, N.W. Camp Ridge, Van Buren, N.W. Cany Branch, Maury, N.W. Cany Spring, Marshall, N.E. Cany, Hickman, N.E. Canyville, Shelby, N.W. Cape Ford, Calhoun, N.E. Cape Hill, Putnam, N.W. Cape, Bluff, Carter, N.E. Carter, Monroe, N.E. Carter, Maury, N.W. Carter, Montgomery, N.E. Carter, Carroll, N.E. Carter, Haywood, N.W. Carp, Iredell, N.E. Carp, Maury, N.W. Carpenter, Washington, N.E. Carpenter, DeKalb, N.E. Carpenter's Creek, Carter, N.E. Carpenter's Creek, Cannon, N.E. Carpenter's Creek, Maury, N.W. Carpenter's Depot, Carter, N.E. Carpenter's Depot, Carter, N.E. Carr, Maury, N.W.<			

TENNESSEE

[illegible]

1. <https://doi.org/10.1016/j.jmb.2019.04.011>

405

© 2004 Blackwell Publishing Ltd *Journal of Internal Medicine* 255: 105–112

406

COUNTIES.	INDEX.	POP.	TOWNS.	COUNTIES.	INDEX.
-----------	--------	------	--------	-----------	--------

[illegible]Hilldale, G
Helden, MI

COUNTIES.	INDEX.	POP.
Koosharem,		
● Lake, Ho		

Ulab	C	78
Box Kider, NW	N	820
Feber	N	100
Box Kider, NW	N	8
mmil	X	50
en, Emery	K	100
Feber	N	50
Cashe	N	307
	N	300
ic	W	X
Feber	C	X
Harard	W	X
erier	C	88
ab	C	0
Whington	SW	87
ic	SW	100
Cous, Salt Lake C	C	120
F	C	100
Pi Ute	S	100
mit	N	300
	SW	100
Iron	SW	300
ard	N	484
Haris	N	1,487
Box Kider	NW	183

UTAH.—VERMONT.—VIRGINIA.

[illegible]

40

VIRGINIA[illegible]

WASHINGTON

WASHINGTON

[illegible]

WEST VIRGINIA.—WISCONSIN.

[illegible]

WISCONSIN.

[illegible]

[illegible]